DOCUMENT RESUME

ED 312 426 CE 053 501

AUTHOR	Nherera, Charles M.
TITLE	Design Education and the Teaching of Woodwork in Secondary Schools.
INSTITUTION	Linkoping Univ. (Sweden). Dept. of Education and Psychology.
SPONS AGENCY	Swedish International Development Authority (SIDA).
REPORT NO	ISBN-91-7870-500-2; LiU-PEK-R-143
PUB DATE	May 89
NOTE	76p.; Master's thesis, Linkoping University.
PUB TYPE	Dissertations/Theses - Master Theses (042) -- Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	Classroom Environment; Course Content; *Design; Developing Nations; Foreign Countries; Instructional Development; *Locus of Control; Problem Solving; Secondary Education; Student Attitudes; Teacher Behavior; *Teacher Expectations of Students; Trade and Industrial Education; *Woodworking
IDENTIFIERS	*Zimbabwe

ABSTRACT

In an attempt to review and, if necessary, update the curriculum, a study investigated the prevalence of problem-solving and design approaches in the teaching of woodworking courses in secondary schools in Zimbabwe. Woodworking classes in forms one and three were studied in an urban secondary school where woodworking is taught up to form four and whose student population is 2,000. The data were collected through questionnaires administered to 5 teachers and 202 students, interviews, lesson observation, and document analysis. The following findings were among those reported: (1) the students, especially in form one, indicated they had very limited autonomy in their practical work; and (2) teachers expected the students to consult with them before proceding to a new stage of work; (3) students, however, had some latitude. They evaluated the completed work; and were encouraged to think independently; (4) more form three students than form ones said they made mock-ups or models of their items; (5) form one students seemed to feel that their practical work was limited mostly to copying teachers' models or working drawings; and (6) students thought the time allowed for woodworking was sufficient, although four out of five teachers considered it insufficient. (The document includes 25 references and appendices containing the woodworking syllabus, questionnaire and interview forms, a sample examination, and statistical summaries of pupil responses.) (CML)

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Design education and the teaching of woodwork in secondary schools

Charles M. Nherera

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DESIGN EDUCATION AND THE TEACHING OF WOODWORK AT SECONDARY SCHOOL LEVEL

Charles M. Nherera

DISSERTATION
submitted as partial fulfilment for an
MA DEGREE IN TECHNICAL GRAPHICS EDUCATION

Linköping University
Department of Education and Psychology
RAPPORT LiU-PEK-R-143

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DESIGN EDUCATION AND THE TEACHING OF WOODWORK AT SECONDARY SCHOOL LEVEL

ISBN 91-7870-500-2
ISSN 0282-4957

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Avdelning, institution, fakultet
Division, department, faculty

LINKÖPING UNIVERSITY
Department of education
and psychology

ISBN: 91-7870-500-2
ISSN: 0282-4957
Rapportnr: Report no: 143
Upplagans storlek: Number of copies: 250
Datum: Date: May 1989

Projekt:
Project:

Titel:
Title: DESIGN EDUCATION AND THE TEACHING OF WOODWORK AT SECONDARY SCHOOL LEVEL

Författare:
Author: Charles M. Nherera

Supervisors: Rolf Holm/ Runa Patel

Uppdragsgivare:
Commissioned by: Linköping University in cooperation with SIDA

Dnr.:
Call no:

Rapporttyp:
Kind of report:

- ☐ Examensarbete/Final project
- ☐ Delrapport/Progress report
- ☐ Reserapport/Travel report
- ☐ Slutrapport/Final report
- ☒ Övrig rapport/Other kind of report

Rapportspråk:
Language:

- ☐ Svenska/Swedish
- ☒ Engelska/English
- ☐ _____

Sammanfattning (högst 150 ord):
Abstract (150 words):

This study investigated the prevalence of problem solving and design approaches in the teaching of Woodwork at secondary school level.

A case study of one secondary school was conducted during the November and December examination period, in 1988. It involved over 200 pupils in Forms one and three, and five teachers in the Woodwork department.

Characteristics of problem solving and design, were formulated into twentysix statements. Questionnaire items were based on these statements. Questionnaires were the main means of collecting data Informal mathods, which included: interviews, document analysis and observations were also used.

It was found that pupils had limited autonomy in practical work. For instance, teachers played the major role in deciding the articles made. Also pupils could not proceed to a new stage without consulting their teachers. Generally, pupils feit that they were not encouraged to come up with their own ideas although the teachers did not agree to this.

The results indicated that teaching was still mainly based on craft approaches. Some characteristics of prcblem solving and design were also identified in the teaching, but they were minimal.

Nyckelord (högst 8):
Keywords (8):

Zimbabwe, Design Education, Craft Education, Secondary Schools, Teaching Approaches, Woodwork

Bibliotekets anteckningar

FOREWORD

This Master of Arts dissertation was prepared within the framework of a bilateral cooperation project between Sweden and Zimbabwe. The Swedish International Development Authority - SIDA - provided financial support for the project.

Linköping University has been responsible for the education in cooperation with the University of Gothenburg. Fifteen students participated in the programme. Three students completed the main part of their education at University of Gothenburg. Twelve students completed their education at Linköping University.

For the twelve Linköping University students, the Department of Crafts and Design held the major responsibility for the courses. The exceptions being the course in research methodology and the actual preparation of the dissertations where the Department of Education and Psychology was responsible. Facilities for the fieldwork were provided by the University of Zimbabwe.

The Department of Crafts and Design has been the host department and responsible for the administration and coordination of the programme.

Linköping May 16, 1989

Bengt Wetterstrand
Head of Department
Dept of Crafts and Design

Lars Owe Dahlgren
Professor and Examiner
Dept of Education and Psychology

ACKNOWLEDGEMENTS

First, I would like to mention Rolf Holm, my original supervisor. My sincere thanks go to Runa Patel, who agreed to supervise me during the last three weeks and at a very short notice. Her thoroughness and willingness to help are most appreciated.

I wish to thank Gordon Evans, tne language consultant, for his friendly and constructive criticism. However, I am fully responsible for any mistakes that might still be there.

The library staff at the Department of Education and Psychology, were always ready to assist and cannot go unmentioned.

I appreciate the services of Lennart Martinsson and Anita Kilander, who ensured that computer facilities and any necessary materials were always readily available.

My thanks also go to Dr Chikombah and Nyagura, of the University of Zimbabwe, for their role in making the staff development programme possible. Dr Nyagura and the two secretaries in the Department of Curriculum Studies, assisted tirelessly during my data collection period.

Finally, I express my special thanks to my wife Karin and our dear daughter Tafadzwa, who sacrificed so much but still kept urging me on.

CONTENTS

	Page
FOREWORD	
ACKNOWLEDGEMENTS	
LIST OF TABLES	11
LIST OF FIGURES	12
BACKGROUND AND PURPOSE	13
1. THEORETICAL FRAMEWORK	15
1.1 Problem solving approaches	15
1.2 Design	16
1.3 Design education and the school curriculum	17
1.3.1 The design process	19
1.3.2 Teaching based on the design approaches	21
1.3.3 Teaching based on the craft approaches	23
1.3.4 Changing perspectives in the curriculum	24
1.4 Research objective	24
2. METHODS AND PROCEDURE	25
2.1 Methodology	25
2.2 Subjects	25
2.3 Data collection methods	26
2.4 Procedure	28
3. PRESENTATION OF THE RESULTS	30
3.1 Description of the results	30
3.1.1 Responses from teachers	31
3.1.2 Responses from pupils	32
3.2 Comparisons	40
4. DISCUSSION OF THE FINDINGS	43
4.1 Summary	43
4.2 Discussion and recommendations	45
REFERENCES	51
APPENDICES	

LIST OF TABLES

		Page
Table 1.	Pupils' responses to item 9 : Do you keep a sketch-book, file or sheets of paper in which you make sketches and notes related to your practical work?	35
Table 2.	Pupils' responses to item 10: Do you make models or mock-ups of the articles to be made?	36
Table 3.	Pupils' responses to item 8 : Do you discuss and make comments on individual articles as a class?	36
Table 4.	Pupils' responses to item 11 : When you finish making an article, do you assess it and suggest how the article could be improved?	36

LIST OF FIGURES

	Page
Figure 1. The Complete Act Of Thought	18
Figure 2. The Design Process	20
Figure 3. Pupils' agreement or disagreement to item 2 : Individual pupils decide their own articles	33
Figure 4. Pupils' agreement or disagreement to item 3 : Both the teacher and pupils decide the articles to be made	34
Figure 5. Pupils' agreement or disagreement to item 4 : Pupils are given timber already cut to size	34
Figure 6. Pupils' agreement or disagreement to item 8 : The teacher expects pupils to discuss problems in practical work and decide how to proceed	35
Figure 7. Pupils' agreement or disagreement to item 12 : Woodwork practical work mostly involves copying the teacher's models or working drawings accurately	37
Figure 8. Pupils' agreement or disagreement to item 13 : Pupils are encouraged to come up with their own ideas about the articles they make	37
Figure 9. Pupils' agreement or disagreement to item 16 : Pupils are encouraged to think independently without relying on the teacher all the time	38
Figure 10. Pupils' agreement or disagreement to item 18 : Woodwork is only suitable for the less able pupils	38
Figure 11. Pupils' agreement or disagreement to item 19 : Woodwork is suitable for both the able and less able pupils	39
Figure 12. Pupils' agreement or disagreement to item 20 : Groupwork is encouraged in Woodwork	39
Figure 13. Pupils' agreement or disagreement to item 21 : The time set aside for Woodwork on the timetable is enough	40

BACKGROUND AND PURPOSE

Background

The provision of technical education in secondary schools dates back to pre-Independent Zimbabwe. Woodwork, Metalwork, Building and Housecraft were the most common technical subjects. They were considered to be more suitable for pupils whose performance in academic subjects was rather weak. Most of the pupils doing these subjects, were expected to join industry as semi-skilled workers.

The whole education system was modelled on the English system. The technical subjects were therefore introduced along the lines of the British elementary schools of that time. The syllabuses were drawn up by examination boards in England. Eggleston (1976) observes that in Britain, subjects such as Woodwork and Metalwork, were intended to provide the necessary pre-vocational training for the rapidly growing ranks of manual industrial workers. The making of artefacts was seen as the primary activity. The main objective seemed to have been the training of industrial workers, who could follow instructions obediently and accurately. The teaching methods were generally authoritarian and uninspiring.

The teacher played the role of the designer and master-craftsman, making decisions at appropriate stages of construction, in order to guide his charge along the predetermined route. Teaching within wood and metal workshops was based on developing skills and techniques. Hughes (1981) points out that the standard of workmanship, which was seen as the ultimate objective, was effectively controlled by the teacher´s demonstrations of techniques. The pupil was only expected to follow the precise instructions unquestioningly. The examination syllabuses called for regurgitated pieces of knowledge and skills, from which almost all creative performance was excluded.

In Britain, the traditional authoritarian teaching methods were being increasingly criticised. Progressive, discovery methods were called for. The design process became the underlying principle of activities in the workshops. Technical and craft subjects were integrated and the changes in these subjects necessitated a redefinition of the curriculum, to design education. Similar developments took place in Canada, Australia, United States and the Scandinavian countries (Eggleston, 1973).

In Canada, as Briggs and Myres (1973) explain, *"...Although the courses are run as separate entities..... A common denominator is based on a design approach"* (p.58). Lundberg (1973) discusses the idea of 'free creating' in contemporary Swedish Sloyd. While it should not be interpreted as unplanned 'laissez faire' he explains, it *"...must be looked upon as a contrast of a former*

model..., where spontaneity and individualization were rather unknown values" (p.33).

In Zimbabwe, no significant changes have been made to the content and teaching methods of technical subjects, even today. In Woodwork for example, traditional, teacher-oriented approaches are still used. The teaching of outmoded skills and techniques is still the norm in most school workshops. In spite of this, Woodwork and other technical subjects in secondary schools, have been given increasing prominence. There are even current attempts to vocationalise the subjects. It therefore becomes necessary that the technical education being provided be reviewed, and the teaching approaches brought in line with those that are empirically proven and progressive . It is however, necessary to first investigate the current situation, and establish a more accurate picture of the teaching approaches being employed. The strengths and weaknesses revealed could then be subjected to further studies aimed at improving the teaching of these subjects.

Purpose of the study

The purpose of this study is to find out the prevalence of problem solving and design approaches in the teaching of Woodwork at secondary school level.

A curriculum needs to be reviewed, updated and adjusted continuously if it is to keep pace with the ever-changing needs of a society. Change for the sake of change is, however, futile if not dangerous. If a better alternative is to be sought thorough investigations should precede any recommendations.

The findings of this study should therefore contribute to the information required to bring the curriculum in line with current needs. It is hoped that the information provided will assist future attempts to improve the teaching of Woodwork and other technical subjects. This should enhance the educational value and status of these subjects. This is particularly necessary since technical education is receiving increasing attention and prominence.

1. THEORETICAL FRAMEWORK

1.1 Problem solving approaches

Problem solving approaches have been advocated since the time of John Dewey. Problem solving has been implicit in terms such as: 'discovery', 'inquiry-discovery', 'learner-oriented', and 'child-centred' methods. A child is presented with tasks rather than specific facts and processes. The child should seek relevant solutions to these tasks, in a systematic manner. The teacher therefore needs to structure the tasks carefully, so that learning takes place as planned.

Taba (1962) observes that the steps involved in problem solving are essentially the steps of a 'complete act of thought', described in Dewey's idea of the process of inquiry. Taba emphasises the importance of mastering the various elements of thinking, such as: generalising, concept formation, analysis of assumptions, application of principles, and the use of these steps in problem solving. He cautions that if these elements are not consciously recognised, problem solving can turn into *"...a ritualistic process of defining any kind of question, collecting any kind of data, hypothesising any kind of solutions, ..."* (p.184).

Tanner and Tanner (1975) concur with Dewey that a worthwhile activity gives the child a chance to formulate and test solutions to problems and to practise the thinking process. They also agree that problem solving is closely related to Dewey's 'complete act of thought' (see Figure1), which is summarised in the following steps:

(a) defining the problem;
(b) noting the conditions surrounding the problem;
(c) formulating hypotheses for the possible solution;
(d) elaborating the probable value of the various hypotheses;
(e) testing the hypotheses to see which idea offers the best solution to the problem. (op. cit.)

These steps resemble the 'design process', described later. They are not necessarily followed in a strict sequential order. Each problem dictates which step should be considered first. According to Dewey, (in Tanner and Tanner, 1975), the steps are *"the indispensable traits of reflective thinking."* (p.256). Problem solving approaches are therefore, a means of launching a child through the 'complete act of thought'.

Educationists seem to agree that problem solving should not be interpreted as letting children grope with problems blindly. Rather, clear guide-lines should be set out so that, while learning takes place in an unrestricted manner, it remains structured and purposeful. Objectives should be specified, since these will enable proper evaluation of the learning process.

The challenge to teachers is in deciding appropriate problem solving tasks, letting children explore and discover solutions freely, but at the same time providing the necessary guidance. There is no one general answer to this dilemma, instead, each situation that arises needs careful consideration. As Dearden, (in Cohen 1983) hints, *"A teaching method which genuinely leaves things open for discovery also necessarily leaves open the opportunity for not discovering them."* (p.53). The teacher should ensure that discovery will take place. Cohen (op. cit.), reiterates Dewey's contention that problems posed should grow out of the experience and be within the range of the pupil's capacity. The problem should be such that it stimulates a desire for information and the production of new ideas.

Problem solving approaches have been adopted and redefined in different subject areas. They have changed the nature of teaching in science, mathematics, and other school subjects (Taba, 1962). In technical subjects, they have however only recently been adopted, giving rise to what has been called design education.

1.2 Design

It seems prudent to examine design at a more general level before coming to the specifics of design education. Attempts to come up with a design theory have been aimed at this general level. Definitions of design are numerous and varied. Different people seem to focus on those aspects of design that are directly relevant to their disciplines and operational levels. Some of the definitions are aimed at the process while others at the end product. However, some common characteristics can be identified that help build a more coherent picture making it possible to specify a 'working' definition embracing the various versions of design. Archer, (in Eggleston 1976), attempts this in his definition. He defines design as that area of human experience, skill, and knowledge, which is concerned with man's ability to mould his environment to suit his material and spiritual needs.

Generally, people seem to associate design with the production of artefacts, as in furniture, engineering or clothes design. However, design is a very broad concept. According to Clay (1976), there is hardly any field of human activity in which the term design is not in use. All the various definitions stress that design is a problem-solving activity which involves a systematic approach to the tackling of problems.

One of the main problems encountered when examining design issues is the lack of a design theory. In a design conference paper, Harris (1982) endorses Mann's conclusion that, *"At the core of the methodological difficulties of any discipline lies the question about the conceptual framework within which to discuss its subject-matter."* (p. 19)

Nevertheless, several models have been suggested and adopted in various design-related professions, in training and in education. In architecture and engineering for instance, design has in most cases become an integral part of the training.

In his paper at the 1982 design conference, Akin describes a design technique commonly used in the training of architects. It is known as instructional criticism and relies on the criticism of a product developed by the student in order to convey to him knowledge of design. He suggests that theories of concept acquisition and learning provide psychological bases for assessing the objectiveness of this method as a teaching tool. The main benefit to students is an increase in their confidence about their ability to design. At the same conference, Kernohan and Daish (1982) referred to a similar technique as the conjecture/refutation approach. Both techniques are based on problem-solving and design principles.

Design is not simply the solving of problems. It is the solving of them according to particular criteria that are based on general design considerations. Various models of design include the following considerations: problem identification, problem definition, problem structuring, preliminary and detail design. Linking these is a continuous process of evaluation, reappraisal and redefinition of the problem, in search of the optimum solution. It is common practice to generate several solutions to a design problem, to then develop, analyse and evaluate each, before deciding on the best one.

Designing demands flexibility in transferring from one thinking mode to another, as the needs of the problem dictate the intellectual skills required at any given time. There is a constant interplay between convergent and divergent thinking. It is these qualities which seem to prove invaluable in design education. In fact the general educational experiences of a child are enriched through design activities. Other common features of a design activity include: brainstorming, sketching, drawing and modelling. Most writers seem to agree that students benefit from exposure to the design process.

1.3 Design education and the school curriculum

Design education has been interpreted in a variety of ways. It is about educating through design activities which are based on the problem solving approaches to education. Shaw and Reeve (1978) give a broad definition of design education which embraces most of the other interpretations. They define it as being, *"...largely concerned with providing experiences through activities, studies, or courses which encourage a wide ranging and balanced approach to two and three dimensional design involving the pupil's physical, intellectual and emotional participation."* (p.1).

Design education is the underlying philosophy of workshop activities which involve problem solving. Traditional craft subjects provide the medium for developing design thinking skills. Design education is therefore an extension of these subjects rather than a substitute for them. Woodwork, Metalwork, Fashion and Fabrics all come under design education. Instruction is based on the teaching principles which emphasise discovery methods. It is achieved through the setting of problems which pupils should tackle methodically.

Design education stresses fact finding, generation and analysis of alternative ideas and problem solving. The 'three ways of thinking' identified by Dewey, (in Zanker, 1979), as 'intuitively', 'empirically' and 'rationally' are all involved in a design activity. The design process, described below, forms the core of design education and is based on Dewey's 'complete act of thought' and 'the process of inquiry'.

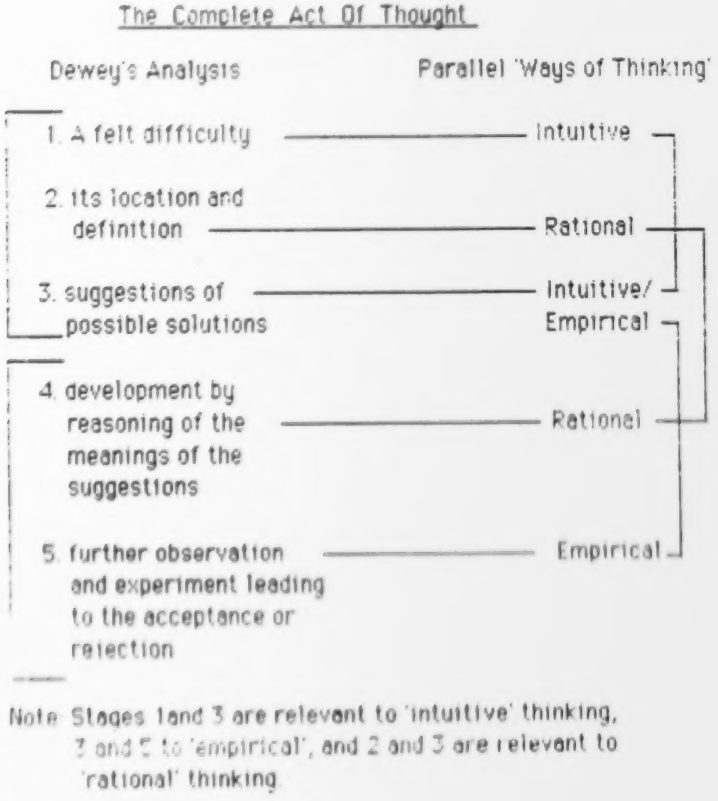

The Complete Act Of Thought
Dewey's Analysis
Parallel 'Ways of Thinking'
1. A felt difficulty
Intuitive
2. its location and definition
Rational
3. suggestions of possible solutions
Intuitive/ Empirical
4. development by reasoning of the meanings of the suggestions
Rational
5. further observation and experiment leading to the acceptance or rejection
Empirical
Note Stages 1and 3 are relevant to 'intuitive' thinking, 2 and 5 to 'empirical', and 2 and 3 are relevant to 'rational' thinking

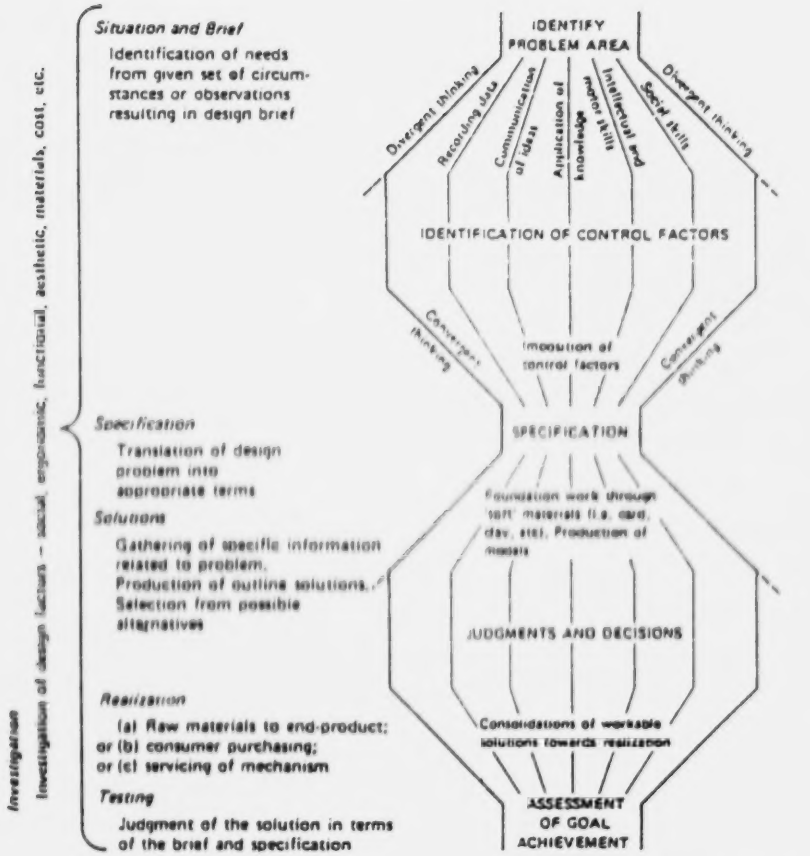
Figure 1. Dewey's Complete Act Of Thought. Source: (Laxton, M. J., 1973, p.89)

1.3.1 The design process

The Design Process is a structured technique for solving practical problems, (see for instance: Eggleston, 1976; Shaw and Reeve, 1978; Baynes, 1969; and Brough, 1985). A problem is solved in stages which are sequentially arranged , with particular aspects being emphasised at each stage. The order followed mainly depends on the nature of the problem, but all stages are important at one time or another during the design process. Summarised, stages of the process are as follows:

1. Situation: identification of the problem.
2. Design Brief: translation of the problem into appropriate terms and stating it clearly.
3. Investigation: research, collection and analysis of data.
4. Solutions: synthesis of the collected data, identification of alternatives and determination of the optimum solution.
5. Optimum Solution: development of the selected idea or design.
6. Model: construction of a mock-up or prototype of the artefact (if necessary) and evaluation of it.
7. Working Drawings: making the necessary production drawings, fully dimensioned.
8. Realisation: making the artefact.
9. Appraisal: testing the final artefact and evaluating it against the original need in order to suggest or make improvements.

Several graphic models have also been put forward to illustrate the design process. The principle behind most of the models is however, basically the same, and they are based on the stages listed above. Arnold (1974) gives a typical model of a design process for secondary schools (see Figure 2) below:


Situation and Brief
Identification of needs from given set of circumstances or observations resulting in design brief
Specification
Translation of design problem into appropriate terms
Solutions
Gathering of specific information related to problem.
Production of outline solutions.
Selection from possible alternatives
Realization
(a) Raw materials to end-product; or (b) consumer purchasing; or (c) servicing of mechanism
Testing
Judgment of the solution in terms of the brief and specification
Investigation
Investigation of design factors – social, ergonomic, functional, aesthetic, materials, cost, etc.
IDENTIFY PROBLEM AREA
Divergent thinking
Recording data
Communication of ideas
Application of knowledge
Intellectual and motor skills
Social skills
Divergent thinking
IDENTIFICATION OF CONTROL FACTORS
Convergent thinking
Imposition of control factors
Convergent thinking
SPECIFICATION
Foundation work through soft materials (i.e. card, clay, etc). Production of models
JUDGMENTS AND DECISIONS
Consolidations of workable solutions towards realization
ASSESSMENT OF GOAL ACHIEVEMENT

A design process for secondary schools.

Figure 2. The Design Process. Source: (Arnold, E., 1974, p. 2).

Design work stems from a situation for which a solution should be sought. The problem should be clearly defined before solutions can be proposed. This is in contrast to merely asking pupils to make an artefact of prescribed specifications. Pupils themselves arrive at the decision to make a particular article, through their investigation and analysis of the defined situation. The teacher should decide the learning experiences which the child is expected to go through, instead of deciding the specific artefacts to be made.

Some design situations arise from existing designs which need to be improved or replaced. Others arise from a practical need. There are several possible design briefs to most situations. The teacher is therefore in a position to determine the complexity of the design problem by imposing certain restrictions. These could be in terms of materials, time and function. The level and experience of the pupils should determine the restrictions imposed. Depending on the nature of the problem, pupils themselves can still adjust the brief as more information becomes available during their investigation.

The investigations will lead to possible solutions. Each solution should be analysed and evaluated thoroughly before being adopted or abandoned. After developing a variety of the solutions, the optimum one is selected. This may be modelled to get a clearer impression. After a solution has been fully accepted, dimensioned drawings are made. All sketches, notes and other pieces of information gathered during the design process, are compiled in a design folder. The need for documentation of the various ideas developed should be emphasised to pupils.

When the optimum solution has been sought and specifications decided, the actual making of the artefact can commence. Craftsmanship is now the main objective. Modifications can still be effected to the artefact, if necessary. All changes should however be recorded. The process of evaluation is on-going and is only concluded after the completed artefact has been tested against the original need.

1.3.2 Teaching based on the design approaches

Teaching within the broader concept of design education is based on problem solving. It follows the principles of the progressive, learner-oriented approaches advocated as far back as Rousseau in the eighteenth century and John Dewey, Froebel and Montessori in the nineteenth century. As mentioned earlier, Dewey in particular was an advocate for science-oriented progressive approaches in which discovery and problem-solving aspects were central features (Cohen, 1983).

Around 1890, Armstrong campaigned for a 'Heuristic' method of teaching, whereby pupils were to work out selected problems and discuss solutions (Zanker, 1979). This was contrasted to existing methods in which pupils simply had to absorb facts presented to them and repeat manual processes.

The design approach lays emphasis on the learning procedure, rather than on mere production of a well made artefact. This does not however imply that the role of manipulative workshop skills should be underplayed. The design process necessarily involves manual as well as mental skills.

In Woodwork, pupils are given a situation from which they identify the problem, work out their own specifications and go through any other relevant design considerations. They only embark on the actual construction of the artefact after exploring several alternative possibilities.

Empirical and theoretical evidence available seems to indicate that the experiences acquired through the design process have educational worth unparalleled by the traditional approaches. According to Eggleston (1976),*"The relevance of the design process to the needs of late twentieth century occupations is unmistakable; it may well be argued that it would be irresponsible for the schools not to provide such experience."* (p.29).

Problem solving situations, offer the opportunity for developing models of thought based on the design process and its application in designing and making activities (Hughes, 1981). The benefits of design education lie in the intellectual demands that arise from the design process as well as its practical nature. Pupils are involved in the design aspects of making, by posing them with practical problems calling for analytic and creative thinking and for personal research and investigation.

Design activities equip pupils with a systematic and analytic approach to problem solving. This will not only help them in workshop activities, but in other subject areas as well as everyday real-life situations. As children gather information for their design problems, they are bound to come across a wealth of other information, knowledge and experiences which will enrich their learning experiences. Team-work, discussion and brain-storming are encouraged in design activities and they help improve the communication and social skills of the pupils. These and many other benefits related to design approaches will make workshop activities an essential component of the general education of a child.

Criticisms levelled against the design approaches tend to be about their improper implementation rather than questioning their fundamental principles. Kimbell (1982) suggests that the 'craft skills teacher' objects to the apparent lack of structure and direction in the design approach. It is argued that pupils at the secondary school age and below will not learn the necessary basic workshop skills due to the freedom allowed in design classes. The standard of their workmanship will consequently be low. This is a fair criticism which a design teacher should take heed of when posing tasks to pupils. For instance, the teacher can decide what workshop skills he wants his pupils to experience, such as making a dovetail joint, laminating wood or whatever. He can then develop a design situation involving these. Most of the traditional craft workshop activities can therefore be specified as design problems.

Design problems, according to Kimbell (1982), exist on a continuum ranging between a total problem and a non-problem. The design teacher has the task of

devising design problems of a suitable degree of difficulty, depending on factors such as age, experience and knowledge of the pupils. The art to teaching design lies in maintaining a balance between the necessary guidance to pupils and the encouragement of independent thinking on their part. Too much freedom will be as bad as too much direction. Through 'guided freedom', pupils should be able to move in gradual steps, from a situation of almost total dependence on the teacher to almost total independence.

Time spent on the preliminary design activities has been considered wasted by those not in favour of the design approaches. Some teachers do not like the fact that in a design project, the solutions to problems and the end results are unpredictable, both to themselves and to the pupils. The teachers may feel they are not in full control of the situation. These criticisms, however do not seem strong enough to justify the continued use of the traditional craft approaches in school workshops.

1.3.3 Teaching based on the craft approaches

In contrast to design approaches are the craft ones. These fit the description of what most writers refer to as traditional. For instance Hirst and Peters (1970) say that education, in the traditional sense, is conceived too much in terms of a set stock of information, simple skills, and static conformity to a code. According to Hughes (1981), the craft teacher´s approach to the curriculum is biased towards skills and techniques with emphasis on workmanship. To ensure the highest possible standards of workmanship, the projects undertaken are generally pre-determined by the teacher and each stage of making being carefully monitored.

In craft approaches, the teaching emphasis is on the mastery of manipulative skills and craftsmanship. Pupils follow carefully devised manual tasks which teach them a variety of skills. These are however, set pieces, designed, thought out and blueprinted by the teacher, (Baynes, 1969). The work is done under strict guidance, with emphasis on motor skill development and memorisation of facts. Such tasks do very little to stimulate the thinking process and are therefore of minimal educational value. They start and end at the 'realisation' stage of a complete design process. Craftsmanship and sound construction which are emphasised here are important, but only as part of the design process. The thinking, planning and analysis that go with problem solving, prior to the actual making of the artefact, should form the core of a child's educational experience.

The craft approaches do lead to high standards of workmanship. However, their educational value has been in question for a long time. The approaches are teacher-centred, uninspiring and do very little to foster decision-making skills and analytic problem-solving. The role of workshop activities needs to be

examined in relation to some overall concept of education and general development of the child.

Since craft approaches only revolve around the making of artefacts, they leave out most of the educational experiences attainable through design education. The overemphasis on mastering of particular workshop skills is rather futile in this day and age when materials, machines and manufacturing techniques are all changing so rapidly. Most of the skills insisted on by traditional craft teachers are in actual fact obsolete. According to Beyth-Maron, et al (1987), modern society is so dynamic that the teaching of facts becomes less vital while the teaching of thinking skills may turn out to be indispensable.

1.3.4 Changing perspectives in the curriculum

Examination syllabuses seem to be focusing increasingly on design education. Both the Zimbabwe Junior Certificate and the 'O' Level syllabuses specify the need to foster problem-solving and design skills in pupils. For instance, aims 1.2 and 1.3 and objectives 2.3 and 2.4, in the Z.J.C. syllabus, all refer to designing and problem solving, (see Appendix 1). The G.C.E. Ordinary Level syllabus, (Appendix 2), states that, *"Importance will be attached to designing ability, the use of information and the solving of problems."* (p.5). The last section in the examination syllabus is actually on Drawing and Design and emphasises the quality of ideas in design as one of the assessment objectives.

The main questions however remain: Is design education, apparent in these official documents, being implemented in schools? If it is, how prevalent is it? How far , if at all, has the balance tilted from the traditional craft to design and problem solving approaches? These questions are fundamental to the purpose of this study.

1.4 Research objective

A study of teaching approaches is rather complex and extensive. Many factors regarding which approaches are in use, need to be considered before any firm conclusions can be drawn. This study focuses on the application of problem solving and design approaches in the teaching of Woodwork. The main objective of the study is to find out: *the prevalence of problem solving and design, as teaching approaches in Woodwork, at secondary school level in Zimbabwe.*

2. METHODS AND PROCEDURE

2.1 Methodology

This study probes into the teaching methods being employed in technical subjects. No research information in this area was found. An exploratory type of study was therefore used. It is assumed that an investigation of the teaching methods being employed at one school, can reveal factors that are common to other schools too.

Taking into account limitations such as time and timing, a case study was decided on as the most appropriate method. Although such a study may not be readily generalised, it does however, penetrate the area of study and give some indication of the total situation.

Cohen and Manion (1985) state that the purpose of a case study is, *"...to probe deeply and analyse intensively the multifarious phenomena that constitute the life cycle of the unit with a view to establishing generalisations about the wider population to which that unit belongs."* (p.120). Bell (1987) confirms the appropriateness of a case study when examining one aspect of a problem in depth within a limited time scale. The case chosen for the study should, however, bear characteristics that are representative of other schools. This view is supported by Shulman (1981) who asserts that the claim that one is conducting a case study requires that an answer be provided to the question, *"What is this a case of?"* (p. 9).

2.2 Subjects

An urban secondary school, where Woodwork is taught up to Form four, was chosen for the study. Most schools offering the subject are in urban areas. The total enrolment was over two thousand. Both academic and technical subjects have always been included in the curriculum. Woodwork is offered to all Form one and two pupils and to those Form three and four pupils who are not doing Physics and Chemistry. These latter classes are streamed into ability groups.

Facilities are similar to those found at other secondary schools offering Woodwork. In its organisational and administrative set up, the school can be regarded as typical. It is a government group B school. This particular school was chosen because it was easily accessible.

To ensure thoroughness, all the Woodwork classes should have been studied. However, due to the external examinations in progress, only Form ones and threes were available.

2.3 Data collection methods

Both formal and informal methods were used to collect data. The questionnaire method described below, was used mainly. The informal methods included: interviews, lesson observations and document analysis.

In order to ascertain the prevalence of problem solving and design approaches in the teaching, characteristics typifying the approaches were identified. They were translated into the following list of statements, from which research instruments were drawn:

1. Teachers decide the articles to be made.
2. Pupils decide their own articles.
3. Both teachers and pupils decide.
4. Pupils get timber already cut to size.
5. Teachers demonstrate new skills and processes.
6. Teachers tell pupils what to do at every stage during practical work.
7. Pupils cannot proceed to a new stage without consulting the teacher.
8. Teachers expect pupils to discuss problems in practical work.
9. Practical work is documented in sketch-books, files, folios, etc.
10. Pupils make models or mock-ups of the articles to be made.
11. Pupils evaluate finished articles.
12. Practical work mostly involves copying the teacher's models or drawings accurately.
13. Pupils are encouraged to come up with their own ideas.
14. Pupils are not experienced enough to come up with their own ideas.
15. Pupils are not allowed to make any changes to their articles.
16. Pupils are encouraged to think independently, instead of relying on the teacher most of the time.
17. Woodwork demands a lot of thinking.
18. Woodwork is only suitable for the less able.
19. It is suitable for both the able and less able.
20. Groupwork is encouraged.
21. The time set aside for the subject is sufficient.
22. Teachers adhere strictly to the official syllabus.
23. The syllabus specifies all topics to be dealt with.
24. The syllabus specifies how the topics should be dealt with.
25. Teachers are free to deal with topics as they see fit.
26. The training of manual skills is the most important aspect in the teaching.

Some of the statements were written in a positive form, others in the negative. The reason for the reversal was to try to avoid soliciting particular responses

from the subjects. The period for collecting the data was not the most appropriate on the school calendar, and it was also short. Research instruments were therefore chosen, which could be administered quickly and cause minimum disruption and inconvenience, to the subjects. Questionnaires were considered the most appropriate. Bell (1987) supports the view that, questionnaires provide an easy way of collecting information quickly and relatively cheaply.

Two sets of questionnaires were made, one for pupils and the other for teachers, (see Appendices 3 and 4). They were both derived from the statements listed above, pertaining to problem solving and design approaches. In most cases, similar items were posed to both teachers and pupils. This was done to verify the responses and obtain a balanced picture. Also some items were repeated in different forms, to cross-check the consistence of the responses. A similar questionnaire was issued to both Form one and three pupils. Items were therefore expressed in a way that could be understood by both forms.

In both questionnaires, items were generally based on a Likert-type, five point equal interval scale. Responses ranged from "Strongly agree" to "Strongly disagree". This was done to enable a quantitative statistical analysis to be easily made on a computer. The order of the responses is shown below:

Strongly agree 1
Agree 2
Not sure 3
Disagree 4
Strongly disagree 5

Some of the items only offered either "Yes" or "No" responses. This was done in instances where an activity either occurred or did not and where a more definite stand-point was required.

The questionnaire for teachers was designed to be used as either an interview schedule or a questionnaire. The original intention was to interview all the teachers, instead of asking them to complete questionnaires. Interviews were preferable since they are adaptable: questions can be rephrased, expanded or manipulated as the situation dictates. According to Bell (1987), *"A skillful interviewer can follow up ideas, probe responses and investigate motives and feelings which a questionnaire can never do."* (p.70). Interviews are particularly appropriate when the subjects are few and accessible, as in this case. However, teachers were very busy and it was found prudent to use the questionnaire method instead. The questionnaires were structured along the same lines as those issued to pupils. No trial runs were made, since the subjects were not supposed to have prior knowledge of the questions, that way preventing the possibility of premeditated responses.

Reliability and validity were mainly ensured through the choice of the sample and structuring of the research instruments. Also, in order to make a complete case, all pupils available in Forms one and three were included in the study. A comprehensive list of items, covering the main characteristics of problem solving and design approaches was drawn. Its completeness was confirmed through an extensive literature review and consultations with experienced specialist teachers. When the questionnaires were made, items were listed in their logical progression to minimise misinterpretations by the subjects.

2.4 Procedure

The study was carried out during the November and December examination period, in 1988. A request for the school to participate in the study, was made through the University and the Ministry of Education. The researcher visited the school a few times before administering the questionnaires. During this period, he acquainted himself with the department. Information concerning the running of the department was collected through informal discussions with teachers and pupils. The information was to help the researcher put responses into context.

The researcher administered all questionnaires to pupils, with the assistance of class teachers. Generally, this was done at the end of lessons. Pupils returned the questionnaires before leaving the workshop. They were immediately checked, to see if they had all been duly completed. In a few instances, pupils had to complete them during their break times. Nevertheless, they returned them on the same day. All pupils were instructed to answer individually, without discussion. It took five working days to meet all classes. Teachers were asked to complete the questionnaires, at times convenient to them. Most of the questionnaires were returned within a day or two.

Additional information was collected to provide an overall impression of the activities within the department. Various unstructured techniques were used to collect this information. Some of it was gathered through informal interviews with teachers, pupils, the headmaster and officials in the Ministry of Education. The information was necessarily related to the questionnaires.

Informal observations of some lessons were carried out. The purpose was to get an impression of the workshop activities and teacher/pupil, pupil/pupil interaction. Aspects sought were directly related to those included in the questionnaires. In order to reduce the possible effects caused by the presence of the researcher, observations were not made obvious to teachers and pupils. Notes on these observations were therefore made after the lessons.

Pupils' work, which included exercise books, drawings and articles were also examined. The work was randomly picked, but note taken regarding the class to

which the pupils belonged. Some of the teachers' schemes and records of work, weekly lesson plans and marking schemes were perused. This was sufficient to get a general impression of the kind of work assigned to pupils.

The textbooks used by different classes were also examined. This was done in conjunction with official syllabuses in current use. Notes were made regarding how much design or craft material was included.

A copy of the end of year Woodwork Design Theory and Drawing paper, (Appendix 5), set for Form three pupils in 1988 was obtained. It shows the areas emphasised in the assessment. The researcher also copied marking schemes for Design and Drawing, and for Practical work, from one of the teachers (see Appendix 6).

3. PRESENTATION OF THE RESULTS

3.1 Description of the Results

The results from the questionnaires are presented in two main parts, responses from teachers, and responses from pupils.

Separating the responses into these groups gives a clearer overall picture of the situation. The description is mainly of frequency distributions of the opinions of the subjects on each item. As discussed earlier, all the data were coded into a computer. The data were then computed using the 'Stat-View 512' program.

Information obtained through informal means is given before presenting the data collected through the questionnaires. Informally gathered information was not processed statistically. Its main function is to provide a fuller picture of the situation at the school.

Three of the Form one classes were taught by one teacher and the other four classes were taught by another teacher. The Form three classes were taught by three different teachers: one teacher taking three of these classes, and the other two teachers sharing equally, the last two Form three classes. All teachers also taught the Form two and four classes not included in this study.

Form ones had five periods per week for Woodwork, while Form threes had six periods. Each period was of 35 minutes duration.

Most decisions concerning the content of the subject were made in departmental meetings. Teachers who taught the same classes made joint decisions regarding what was to be done in both theory and practical work. All Form one classes made identical articles, while some variations were observed in articles made by the Form threes. From Form three level, pupils suggested possible designs. The teacher vetted these, chose the best three and made specifications as he saw fit. The whole class divided into groups, was then asked to make these articles. The major constraint in practical work was the limited amount of materials and tools.

Written work in both Forms one and three was generally similar. In the exercise books, it mostly comprised of brief notes accompanied by sketches of joints, tools, etc. Form threes also used folders in which they made drawings related to their practical work. Most of the textbooks in use gave factual theoretical information. Those used by Form three and four pupils also included some sections on design.

Teachers schemed on a weekly basis and planned daily. The schemes detailed the work to be covered, stating the articles to be made and their specifications.

Skills and processes involved in practical work were listed. Both Schemes and Plan books were vetted by the Head of Department and the Headmaster regularly.

3.1.1 Responses from teachers

All the five Woodwork teachers in the department participated in the study. They were all males and included the Head of Department. Their ages ranged between about twenty and fifty. Teaching experiences spanned from one to over fifteen years. Only two of them had been at the school for more than three years. Three of the teachers had secondary school teachers certificates. One was a final year student teacher and the other was untrained. He had completed 'A' level studies the previous year, having done Woodwork at school up to 'O' level. All teachers taught only Woodwork in which four of them had 32 periods each, while the fifth teacher had 36 periods. Only one teacher did not share his workshop.

The teachers all took definite stands in their responses. They answered all questions and, even where the 'Not Sure' option was included, none of them took this stance. It should be noted therefore, that where the responses of only some of the teachers are mentioned, the remaining responses express the opposite view.

All five teachers responded that they prepared their own schemes of work. They all agreed that they adhered strictly to the official syllabuses from the Ministry, and that the syllabuses specified all topics to be dealt with. Only two of them however agreed that these syllabuses specified how the topics should be dealt with. The five teachers agreed, two strongly, that they were free to deal with topics in the manner they saw fit. The responses to these items indicate whether or not teachers felt they had restrictions, which could influence their teaching approaches.

Four of the teachers agreed that they decided the articles made in practical work. A further probe showed a disagreement by three out of the five teachers, that individual pupils decided their own articles. Three agreed and two disagreed that both teachers and pupils decided the articles made. These responses are all related to the autonomy given to pupils in designing projects in practical work.

Teachers were asked their perceptions regarding particular aspects of teaching. Four of the teachers believed that the training of manual skills was the most important aspect, and three teachers disagreed that practical exercises were mainly concerned with how well pupils could follow instructions, working drawings and models, accurately. Only two agreed that pupils were encouraged to think independently, without relying on the teacher all the time. However, three felt that pupils were experienced enough to come up with their own ideas.

While four teachers disagreed, three strongly, to the suggestion that Woodwork was mainly suitable for the less able, one teacher strongly agreed. Again, four agreed that groupwork was encouraged and disagreed that the time set aside on the timetable, was sufficient.

3.1.2 Responses from pupils

In the chosen school, twelve classes participated: seven Form ones and five Form threes. Of the total of 253 pupils in these classes, 202 were available, 126 Form ones and 76 Form threes. These pupils were all males aged between thirteen and twenty. The mean ages were approximately: 14,7 years in Form one and 16,6 in Form three. Most of them had started their secondary education at the same school. Only nine had come from other secondary schools. Pupils in each Form all took the same subjects.

In practical work, Form ones had made pot-stands and towel-racks. The articles made by all the seven classes were identical. Form threes had either made bedside cabinets or tables with drawers. Each of the Form three classes had been divided into three groups and the articles were made according to these groups.

Bar charts and tables are included in the following results to depict the detailed distribution of the responses to some items. The large number of pupils involved necessitate graphical representations, to support verbal descriptions. Percentages, instead of the number of pupils, are used to explain the results. All the pupils' responses were computed collectively, as shown in the bar charts and tables. Form ones and threes were then treated separately, to facilitate a fuller description of the responses

In the tables, "Bar" refers to the number of options under each item in the questionnaire. "Element", in both bar charts and tables, shows the actual options, while "Count" is the number of subjects who chose each particular option. "Percent", expresses the count as a percentage of the total number of subjects. "Mode", indicates the element chosen by most of the subjects in their responses.

Five elements are given in each bar chart. For the purposes of this study it is however, only interesting to find out for each item how many of the subjects agreed and how many disagreed. The five point scale was used only to avoid the possibility of responses clustering under one element. The "Not Sure" responses are therefore considered less important. In the case of descriptions expressing percentages, whether subjects "Strongly Agree" and "Agree", they are still counted as agreeing. The same applies to those disagreeing or strongly disagreeing. The finer distinctions over the whole scale are only shown in the bar charts.

Additional statistical summaries describing: means, standard deviations, the total count of the subjects, minimum and maximum values of the options provided and ranges, are given in Appendix 7.

Pupils in both forms were nearly unanimous in their agreement to the statement that teachers decided the articles to be made. Over 90% of the pupils expressed this view.

About 65% of the pupils in each form, disagreed that they decided their own articles. Just over 24% of the Form ones agreed to the statement, compared to over 29% in Form three. Figure 3 shows the combined responses.

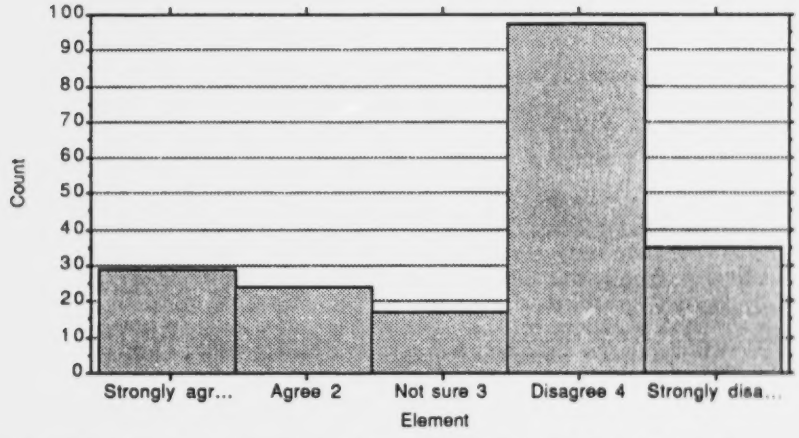


Figure 3. Pupils' agreement or disagreement to item 2 : Individual pupils decide their own articles

While approximately 47% of those in Form one agreed that teachers and pupils together decided the articles to be made, almost 70% of the Form threes agreed that they did. Figure 4 shows the variation in the combined responses.

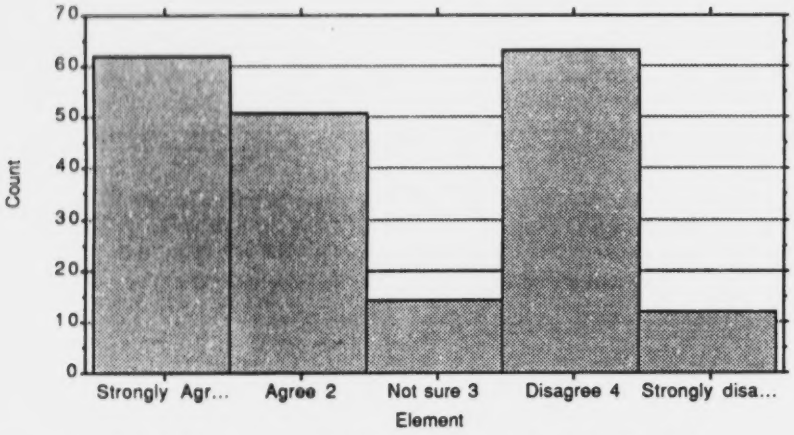


Figure 4. Pupils' agreement or disagreement to item 3 : Both the teacher and pupils decide the articles to be made

Most pupils indicated that they cut their own timber to size, as shown in Figure 5. Over 59% in Form one and 73% in Form three gave this response.

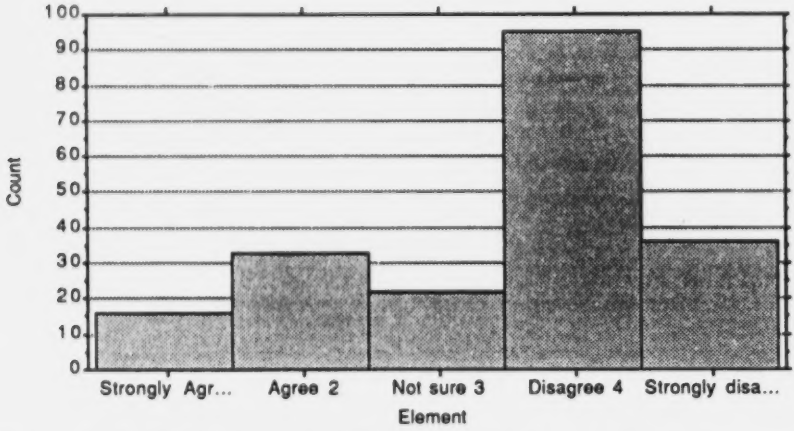


Figure 5. Pupils' agreement or disagreement to item 4 : Pupils are given timber already cut to size

There was an overwhelming agreement to the statement that teachers demonstrated new skills and processes. Over 88% of the pupils gave this response.

Both Form ones and threes agreed that teachers told them what to do at every stage during practical work. About 95% of the pupils gave this response.

Over 68% of the Form ones and 54% of the Form threes agreed that teachers expected them to discuss problems in practical work. The combined responses in Figure 6, depict agreement by almost 63% of the pupils in both classes.

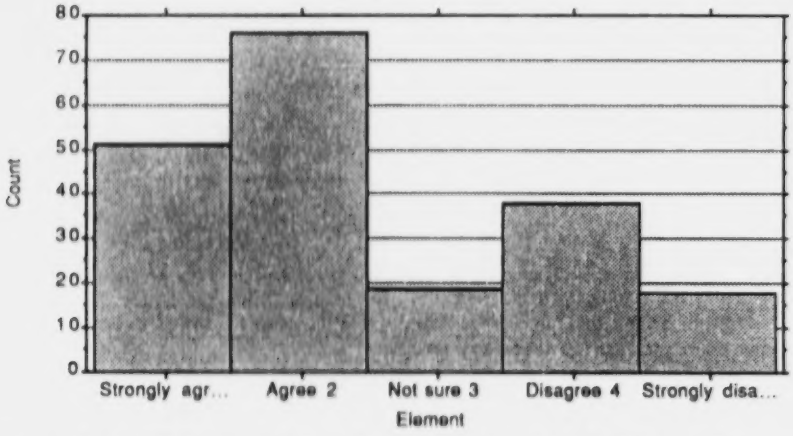


Figure 6. Pupils' agreement or disagreement to item 8 : The teacher expects pupils to discuss problems in practical work and decide how to proceed

Over 73% of the pupils in each form indicated that they used sketch-books, files or sheets of paper in practical work. The combined responses are depicted in Table 1.

Table 1. Pupils' responses to item 9 : Do you keep a sketch-book, file or sheets of paper in which you make sketches and notes related to your practical work?

Bar:	Element:	Count:	Percent:	
1	Yes	148	73.267	-Mode
2	No	54	26.733	

Only 39% of the Form ones indicated that they made models or mock-ups of their articles, compared to 59% in Form three. Overall, as depicted in Table 2, more pupils disagreed that they made models or mock-ups.

Table 2. Pupils' responses to item 10: Do you make models or mock-ups of the articles to be made?

Bar:	Element:	Count:	Percent:	
1	Yes	94	46.535	
2	No	108	53.465	- Mode

More than 67% of those in Form one and 73% of those in Form three agreed that they discussed projects in practical work, as a class. Table 3 shows the combined responses.

Table 3. Pupils' responses to item 8 : Do you discuss and make comments on individual articles as a class?

Bar:	Element:	Count:	Percent:	
1	Yes	139	68.812	- Mode
2	No	63	31.188	

As can be seen in Table 4, pupils mostly indicated that they evaluated their practical work.

Table 4. Pupils' responses to item 11:When you finish making an article, do you assess it and suggest how the article could be improved?

Bar:	Element:	Count:	Percent:	
1	Yes	152	75.248	- Mode
2	No	50	24.752	

More than 87% of the Form one pupils thought that practical work mainly involved copying. In Form three however only 50% thought so, while 34% disagreed. Overall, 73% of the pupils agreed to the item, as shown in Figure 7.

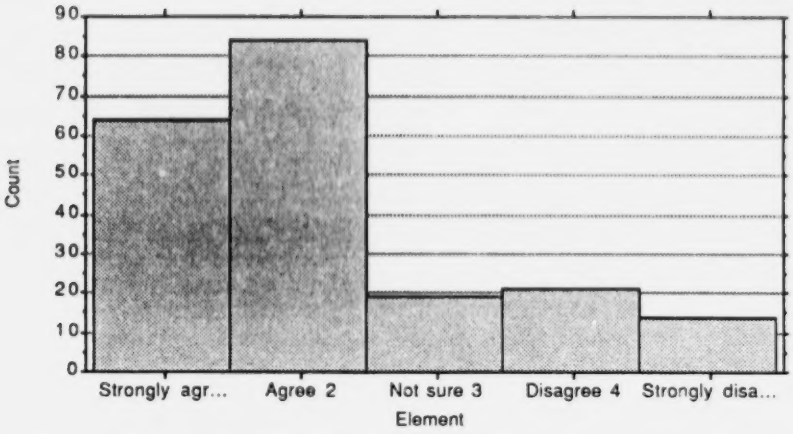


Figure 7. Pupils' agreement or disagreement to item 12 : Woodwork practical work mostly involves copying the teacher's models or working drawings accurately

Most pupils in both forms did not think they were encouraged to come up with their own ideas. In Form one over 58%, and in Form three 47%, disagreed to the statement that they were encouraged to do so. Overall, more than 44% disagreed, compared with 45% who agreed in both classes, as depicted in Figure 8.

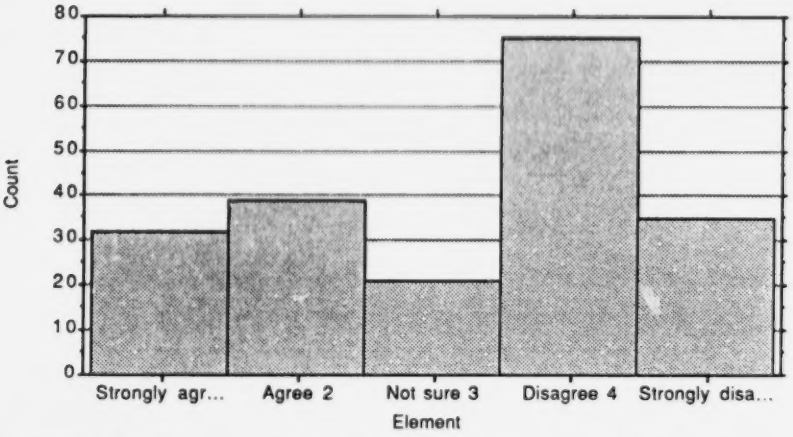


Figure 8. Pupils' agreement or disagreement to item 13 : Pupils are encouraged to come up with their own ideas about the articles they make

Most pupils in both Form one and three felt that the subject required a lot of thinking. Over 81% of them expressed this opinion.

More than 59% of those in Form one and 52% in Form three, agreed that they were encouraged to think independently. Figure 9 shows the overall impression of the responses.

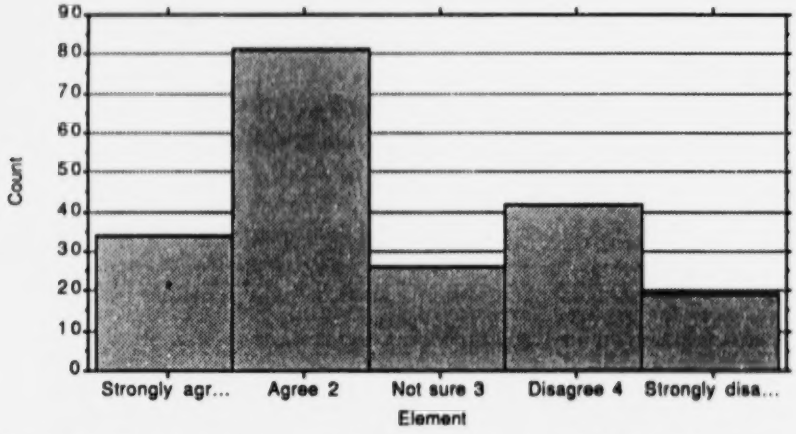


Figure 9. Pupils' agreement or disagreement to item 16 : Pupils are encouraged to think independently without relying on the teacher all the time

Figure 10 shows that only 17% of the pupils in both Forms thought the subject was only suitable for the less able.

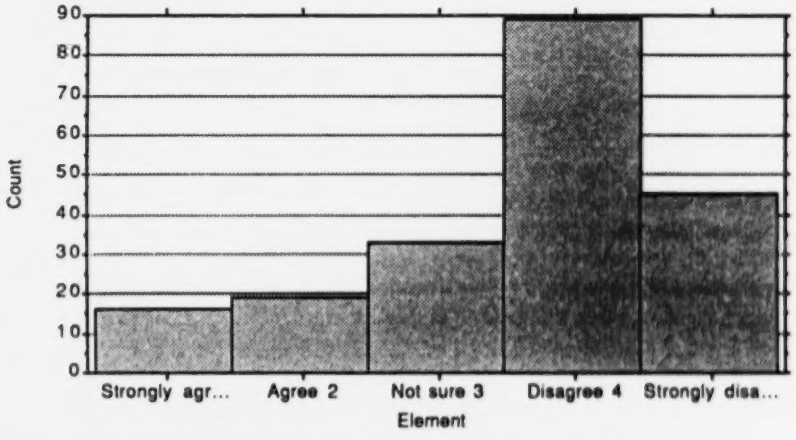


Figure 10. Pupils' agreement or disagreement to item 18 : Woodwork is only suitable for the less able pupils

According to the majority of the pupils, the subject was suitable for both the able and less able. More than 74% of pupils in both Forms agreed with this statement, as illustrated in Figure 11.

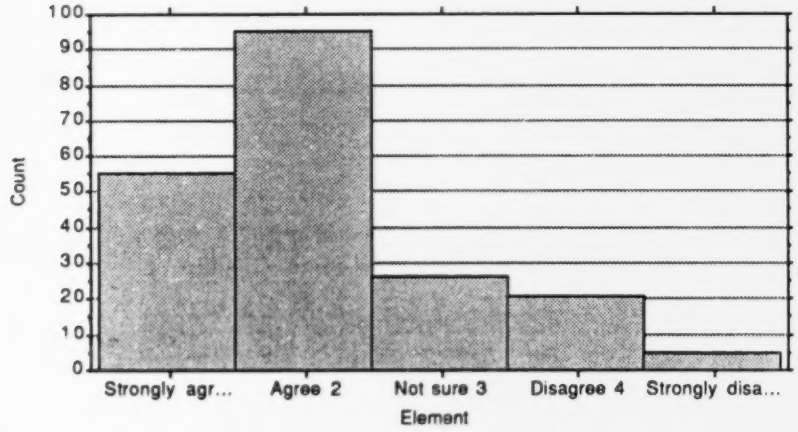


Figure 11. Pupils' agreement or disagreement to item 19: Woodwork is suitable for both the able and less able pupils

In Form one, 43% agreed while another 43% disagreed that groupwork was encouraged. In Form three, over 63% agreed and only 27% disagreed to the statement. The combined responses are depicted in Figure 12.

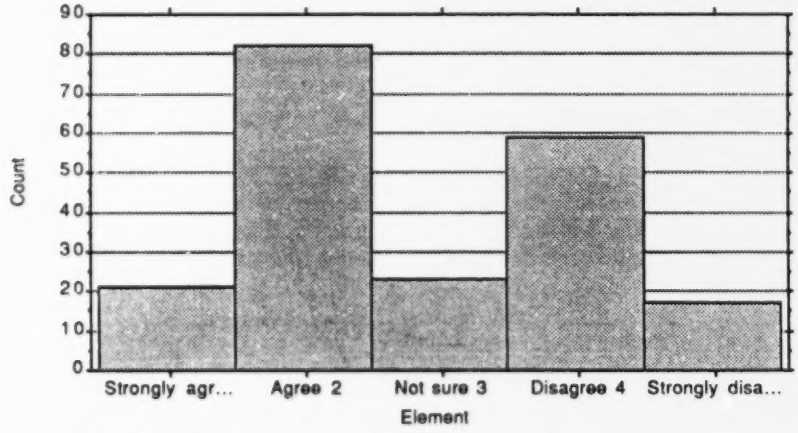


Figure 12. Pupils' agreement or disagreement to item 20 : Groupwork is encouraged in Woodwork

As Figure 13 shows, both Form ones and threes generally felt that the time set aside for the subject was sufficient. Approximately 75% of those in Form one and 62% in Form three indicated this response.

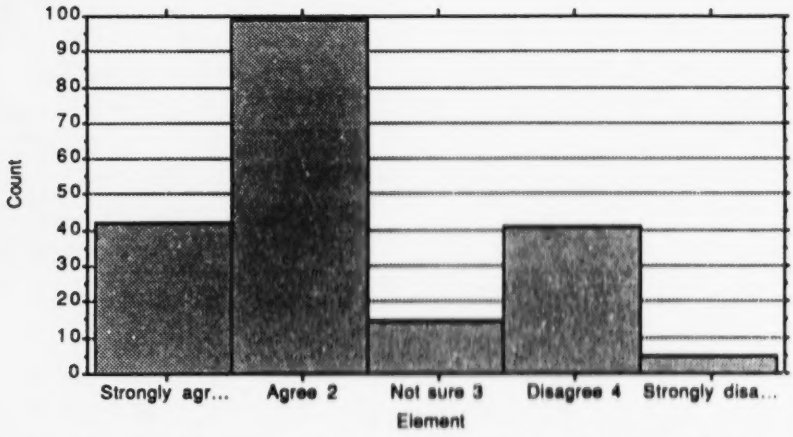


Figure 13. Pupils' agreement or disagreement to item 21 : The time set aside for Woodwork on the timetable is enough

More than 97% of the pupils answered that they liked the subjects.

3.2 Comparisons

Responses to each item are summated and analysed collectively and the significance of each variable mainly depends on the overall responses from subjects. For instance, if most of them indicate "Strongly Agree" and "Agree" or "Yes", in their responses to a particular statement, the statement can be regarded as likely true.

It is the number of subjects responding to a particular item that is of interest in this analysis. The "Yes" and "No" responses are based on a two point equal appearing interval scale. The only difference with the five point scale is in the number of options which subjects can choose from. Data that are coded in this manner are easy to process, for instance to get frequency distributions, measures of central tendency and when comparing variables.

For analysis purposes, the interval between each point on the scale is assumed to be equal. As Tuckman (1978) observes, the equal-interval assumption is workable, since analyses of data from Likert scales are usually based on summated scores over a number of items. Statistical analysis is based on the data collected through questionnaires. Additional information obtained through

informal interviews, document analysis, observations and personal experience of the researcher, is only used in the discussion.

The results show only few variations in the responses. Subjects were generally consistent, even when the statements were put in different forms. In order to give the overall picture of the results, responses from Form ones and threes are compared first. Combined responses from the two Forms are then related to those from the teachers.

Responses from Form one pupils were largely similar to those from the Form threes. Notable variations, nevertheless, occurred in some cases. Only instances where the difference in responses between the two classes exceeded 5%, are cited below.

In Form one, approximately 47% of the pupils agreed and another 47% disagreed to the suggestion that both teachers and pupils decided the articles made in practical work. Different responses were obtained from the Form threes. Almost 70% of them agreed while only 22% disagreed to the statement.

Another variation was observed in responses to the item asking whether pupils were given timber already cut to size. The number of pupils who disagreed was much more in Form three, where 74% gave this response, compared to 59% in Form one.

Form ones were more in agreement to the item suggesting that teachers expected them to discuss problems in practical work. Over 68% of them were of this opinion, compared to 54% in Form three.

More Form threes indicated that they made models or mock-ups of their articles. Over 59% of them said they did as compared to only 39% of the Form ones.

The statement that practical work mostly involved copying the teacher's models or working drawings accurately, was supported by 87% of the Form one pupils. In Form three 50% agreed. Only 6% of the Form ones disagreed, compared to 34% in Form three.

While over 58% of the Form one pupils disagreed to the suggestion that they were encouraged to come up with their own ideas, in Form three 47% disagreed. About 32% in Form one and 39% in Form three agreed to the statement.

Only a slight difference was seen in responses to the item suggesting that pupils were encouraged to think independently. More than 59% of the Form ones agreed, supported by 52% in Form three.

There were differences of opinion to the suggestion that groupwork was encouraged. Responses in Form one were balanced, with 43% in agreement and another 43% disagreeing. In Form three on the other hand, 63% thought groupwork was encouraged, with only 27% disagreeing.

More Form one pupils felt that the time set aside for the subject was sufficient. Approximately 75% of the Form ones and 62% of the Form threes were satisfied with the time allocated. Over 30% of those in Form three but merely 18% in Form one, felt that more time was required.

Generally, responses from teachers and those from pupils in both Forms one and three, showed little variation. While most pupils insisted that teachers alone decided the articles made, four teachers out of five, agreed that they did, but three of the teachers claimed that pupils were also involved.

All the teachers indicated that pupils were allowed to make changes to their articles. Pupils, on the other hand, particularly in Form one, did not think they had this freedom.

Although four of the teachers agreed and only one disagreed that groupwork was encouraged, 43% of those in Form one and 27% in Form three disagreed. The difference of opinion between teachers and pupils was more pronounced in Form one.

Four of the teachers did not think the time allocated for Woodwork was enough. On the other hand, almost 70% of the pupils thought the time was sufficient.

4. DISCUSSION OF THE FINDINGS

4.1 Summary

The purpose of this study was to find out the prevalence of problem solving and design approaches in the teaching of Woodwork. The first task was to explain the meaning of these approaches and spell out what they entail. Problem solving was traced as far back as the eighteenth century. Design approaches, on the other hand, is a newer concept that is based on problem solving approaches, but particularly pertaining to technical areas. Both problem solving and design approaches emphasise reflective thinking and are contrasted to craft approaches, which are criticised for their overemphasis on manual skills, and their inability to stimulate thinking.

Teaching approaches generally overlap and, it is not possible to draw distinct lines separating one from the other. Accordingly, in order to focus the study, the researcher found it necessary to identify characteristics that are typical to problem solving and design approaches. These were formulated into twenty six statements, covering the aspects which this study set out to investigate. Questionnaires, used as the main research instruments, were derived from these statements.

The major constraints of the study were related to the timing and limited time scale. Data were actually collected during the end of year examination period. Consequently, a case study of one school was decided on as the most suitable research design, while the use of questionnaires further helped alleviate the problem.

All the questionnaires issued were completed fully, suggesting that both teachers and pupils understood the items. Responses from all the subjects concurred in most instances. Nevertheless, the variations which occurred, warrant a further description.

In the first instance, most Form threes agreed that both teachers and pupils decided the articles made, but Form ones were split in their responses. A much larger proportion of pupils in Form three indicated that they cut their own timber for practical work. More Form ones felt that teachers expected them to discuss problems in practical work.

There were more positive responses from Form three pupils to the question whether they made models or mock-ups of their articles. Most of the Form one pupils gave negative responses to this item. The prevailing opinion in Form one was that practical work mostly involved copying teachers' models or working drawings accurately.

Teachers unanimously agreed that they decided the articles made by the Form ones, but involved Form threes to a limited extent. Although both Form ones and threes largely felt that they were not allowed to come up with their own ideas, the feeling was more common among the Form ones. Pupils in both Form one and three felt that they were not encouraged to think independently, but this feeling was stronger in Form one.

While four teachers were of the opinion that they decided the articles made in practical work together with pupils, most pupils disagreed. Also, pupils, particularly Form ones, did not agree with the teachers that they (pupils) were free to make changes to their articles.

Four teachers and most of the Form three pupils agreed that groupwork was encouraged, while responses from the Form ones were split. On the whole, pupils were satisfied that the time allocated for Woodwork was sufficient, although the proportion of pupils expressing this view was much higher in Form one. Contrary to the opinion expressed by most of the pupils in both Forms one and three, four out of the five teachers thought the time allocated for Woodwork was not enough.

It seems that pupils, especially in Form one, had very limited autonomy. Responses from the pupils indicated that:

1. teachers decided the articles made;
2. individual pupils did not decide their own articles;
3. pupils in Form one did not have a say, but those in Form three decided on the articles together with their teachers;
4. teachers told pupils what to do at every stage during practical work;
5. pupils in Form one were not allowed to make changes to their articles, but those in Form three could do so;
6. pupils were not encouraged to come up with their own ideas.

The results however, show that pupils had some latitude in their practical work. The following findings support this view:

1. teachers expected the pupils to discuss problems in practical work, either on their own, or as a class. More Form ones expressed this view;
2. pupils evaluated their completed articles;
3. pupils were encouraged to think independently;
4. Form three pupils proposed articles in practical work though the teacher made the final decisions. The pupils were also allowed to make changes to their articles. They used drawing folders for sketches related to their practical work;
5. a larger proportion of pupils in Form three made models or mock-ups, to try out their ideas.

Concerning their own perceptions of Woodwork, pupils expressed the following opinions:

1. practical work mostly involved copying teachers' models or working drawings accurately;
2. the subject demanded a lot of thinking;
3. the subject was suitable for both the able and less able;
4. the time allocated to the subject was adequate.

Other findings concerned pupils perceptions of the day to day activities, such as:

1. pupils mostly cut their own timber to size;
2. teachers demonstrated new skills and processes;
3. groupwork was encouraged.

The responses from teachers indicated that, while the official syllabuses specified all the topics to be covered, teachers were free to use their own methods. Only two of the teachers felt completely bound by the syllabuses.

Most of the teachers regarded the training of manual skills as the most important aspect in their teaching. Two of them thought that practical work was mainly concerned with how well pupils could follow instructions, working drawings and models. Three teachers indicated that pupils were not encouraged to think independently. They felt, however, that pupils were experienced enough to come up with their own ideas.

4.2 Discussion and recommendations

On the whole, evidence from the findings seem to imply that teaching was not mainly based on problem solving and design approaches. Rather, it still leaned towards craft approaches. For instance the design process, which is the core of design education, was not evident in the workshop activities. Some characteristics of problem solving and design were however identified in the teaching approaches in use, but they were very limited.

Contrary to problem solving and design approaches where pupils are fully in charge of their individual articles, teachers still played the major role in practical work. When teaching is based on problem and design, teachers should only identify learning experiences, and let pupils grapple with problems as they seek the necessary solutions. The role of the teacher in practical work becomes that of a guide, rather than a leader.

Most pupils conceived practical work as mostly involving copying teachers' models and drawings. This is probably due to their experiences in the workshop, suggesting that teachers employed such approaches. This viewpoint is confirmed by several findings, for instance: pupils did not feel they were

encouraged to come up with their own ideas, they had to consult the teacher at every stage when making articles, and Form ones in particular, were not allowed to make changes to these articles. The demonstrations of skills and processes by the teachers could also lead to pupils believing that practical work was mainly concerned with copying. For instance, if teachers performed these demonstrations on articles similar to the ones made by pupils, pupils would tend to emulate both the skills and how the actual articles were detailed. In a typical design situation on the other hand, pupils perceive practical work as a continuous search for optimum solutions.

The findings show that the official syllabuses only specified the topics, and not the methods to be used. It would appear then, that teachers had complete freedom in their teaching. There are however, other factors which could influence the teaching approaches adopted, for instance, the requirements of external examinations. School learning tends to be judged in terms of the performance of pupils in public examinations. In such a situation, teachers are bound to employ teaching approaches that, in their opinion, ensure the highest number of passes.

The examination questions unfortunately, mainly ask for factual knowledge and do not stress understanding. A copy of the Theory, Design and Drawing Paper in Appendix 5, confirms this assertion. In the Theory section, pupils were mostly required to remember names and uses of joints, tools, materials and so on, while in the Design and Drawing section, they were asked to reproduce the given drawing in different views. Only the handles of the Tea Tray were left for pupils to design and, even then, the given drawing suggested the possible shape and location of these handles.

Although the assessment objectives of the examination syllabuses in use mentioned problem solving and design, the actual questions only asked for factual information and competence in specific manual skills. The examinations did not give much scope for experimentation, which is a necessary part of design work. It is likely therefore, that teachers in their endeavours to meet the requirements of these examinations, found it best to be more directive and specific in their teaching. The marking schemes which were in use, (Appendix 6), did not stress understanding either. In Practical work for instance, assessment was based on competence in executing specified manipulative skills. The researcher believes that examinations were the greatest single influence on the teaching approaches which were in use.

Another factor which could have some bearing on the teaching approaches, is the amount of time allocated to the subject. Time becomes a very important consideration when teaching is examination oriented. In that situation, teachers tend to aim at getting through the syllabus, and even leave ample room to revise different topics before the examinations. They regard experimentation,

personal investigation for information by pupils, and other activities related to problem solving and design, as a luxury they cannot afford.

The findings in the current study revealed that teachers felt that time was insufficient. Pupils disagreed, probably because they managed to complete given tasks within the specified time. However, teachers would naturally only assign work that was manageable in the time, but not all the work they would have liked to give. The time constraint, coupled with the demands of public examinations, would leave very little opportunity for teachers to employ problem solving and design approaches in their teaching, particularly if their experience in these approaches was limited.

Four of the teachers shared their workshops, and could not therefore allow pupils to continue with their practical work outside the normal contact periods. Also the school operated in two sessions, with one group of pupils coming in the morning and the other, in the afternoons. Workshop facilities were therefore in use by different classes the whole day. Neither teachers nor pupils could therefore spend as much time in the workshops, as they would probably have liked. Design work would be difficult to implement in such circumstances, particularly if teachers did not have the relevant experience.

The experiences of teachers, both during training and in the field, influence the teaching approaches they adopt. The researcher's own experience is that problem solving and design approaches were neither emphasised in teacher's colleges nor in schools. According to the qualifications and experiences of the teachers who participated, it is likely that they did not have sufficient knowledge in design education.

The number of periods taught and the sizes of classes, can also affect teaching adversely. Generally, teachers taught more than thirty periods per week. Besides, the classes were rather large at Form one level where as many as twenty four pupils could be found in one workshop. Teachers could not afford pupils the individual attention called for in problem solving and design. In a typical design class, pupils deal with different problems concurrently. The teacher needs to be experienced in design activities, to manage such a class, particularly while teaching over thirty periods per week.

There were variations in the responses from Form one and three pupils, suggesting that different teaching approaches were employed. Generally, Form three pupils had more autonomy than the Form ones. This is in line with design education since the degree of decision-making which pupils are allowed, must depend on their level of skills and experience. However according to the findings, even the Form threes had very limited freedom.

The notion that practical work stressed how well pupils could follow instructions, working drawings and models accurately, was supported by two

of the teachers. In fact, most of the teachers considered the training of manual skills as the main objective. They also indicated that pupils were not being encouraged to think independently. On the other hand, teachers felt that pupils, particularly at Form three level, were experienced enough to come up with their own ideas. This is a contradiction between what the teachers thought of the pupils' abilities, and what they actually allowed the pupils to do.

Teaching that is based on craft approaches is of limited educational value. The essence of education should be the complete development of a pupil, (see for instance, Hirst and Peters, 1970). Pupils should be equipped with the necessary skills and knowledge, to meet their individual needs and the needs of the community and society at large.

School learning should give pupils the opportunity to develop their cognitive skills, manipulative skills and knowledge, social skills, attitudes and values. Cognitive skills can be developed when learning focuses on: enhancing the decision-making skills of pupils, developing critical minds in pupils, and encouraging constructive evaluation of their own and other people's work or products in everyday use.

Manipulative skills and knowledge can be fostered by: developing an understanding and knowledge of materials and the safe way to deal with them; providing pupils with the necessary manual skills and knowledge that will help them to gainfully engage in either the formal or informal sector of the economy. Since both the materials and working techniques are changing so rapidly in the modern technological world, pupils should be versatile and innovative, rather than being thoroughly skilled in a specific area only.

Curricula objectives should include the development of social skills, attitudes and values. Schools should also foster communication and interpersonal skills and encourage cooperation and social interaction. The methods of working encouraged in design activities, such as groupwork, help develop such qualities. Also, design work encourages pupils to discuss among themselves, and to seek information from other subject areas or from the community.

The aims of design education at secondary school level, should encompass all the qualities described above. The benefits of technical education can only be fully realised through design education, in which workshop activities are aimed at involving both the mental and manual capacities of pupils. Merely concentrating on developing manual skills without due regard to cognitive development, is educationally void. Practical exercises should only be decided on after their mental benefits have been clearly identified.

Design education encourages innovation and creativity, and enhances the skills of problem solving, decision-making and evaluation, all of which are valuable in adult life. At the same time, design activities generate an awareness of the

qualities of the man-made world (Eggleston, 1976). One of the main features of design education, is the direct participation of the pupils in the learning process, instead of remaining passive recipients of pre-digested facts. Design work motivates pupils as they realise the importance of their own decisions in different tasks.

The current study has emphasised the importance of basing the teaching methods in Woodwork, and indeed all technical subjects, on problem solving and design. The researcher offers the following recommendations:

1. Examination syllabuses should be reviewed, to ensure that questions lay less emphasis on factual information and concentrate more on testing understanding.
2. Before teachers are acquainted with design education, more periods could be made available for practical work. However, once they get the necessary experience, design tasks may actually require less contact time since, design work continues even outside the workshop and away from the teacher, as pupils seek the solutions to their problems on their own.
3. Teachers should be informed more about design education. This could be done through circulars from the Ministry of Education, seminars and workshops. Holiday courses could also be run for teachers, and reading materials should be made available.
4. Teachers themselves should aim at making their teaching more pupil-centred, for example, by allowing pupils to make more decisions concerning their practical work.

In drawing the conclusions in this study, it is acknowledged that further studies are necessary to confirm the findings. The characteristics identified in the current study as typifying problem solving and design approaches, could first be revised to ensure that they actually do fully cover all the aspects that need investigation. The use of different research methods could yield different, new, or for that matter, more conclusive evidence. More teachers, pupils, and schools could also be involved to try and generalise typical characteristics of the teaching approaches in use. All the same the evidence in this study does provide a stepping stone.

Technical subjects will continue to be looked down upon if they continue to pay insufficient attention to mental skills and only concentrate on manipulative skills. All countries, especially developing countries like Zimbabwe, need people who can come up with original ideas. Zimbabwe needs people who can identify problems and seek relevant solutions. New products, industrial development, the improvement of the material world and of the general development of the country, requires people who are practical, innovative and versatile. Technical subjects, through problem solving and design approaches, can contribute by inculcating such qualities in the young minds.

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MINISTRY OF EDUCATION

Z.J.C. Forms I - II

examination 1984

WOODWORK

Curriculum Development Unit.
P.O. Box MP 133, Mount Pleasant
HARARE

1. AIMS

By the end of the course students should be able to:

1.1 Make pieces of furniture and other useful wooden objects.

1.2 Work out designs of wooden objects and make clear, accurate drawings of their designs.

1.3 Look objectively at the work they are doing and;
a) think of improvements to the product,
b) devise ways of working more efficiently.

1.4 Relate their knowledge and skills in woodwork to the wider context of society and socialist development.

2. OBJECTIVES

There are literally hundreds of specific learning objectives which could be listed. Each teacher should carefully consider what he wants his students to learn, lesson by lesson and term by term, bearing in mind his particular circumstances and the resources available. As a guide we have identified five main categories of skill.

2.1 Manual Skills:
e.g. planing down to a line, assembling a mortice and tenon joint, applying a coat of varnish, etc.

2.2 Perception and Communication Skills:
e.g. Noticing when a tool needs sharpening, judging the straightness of a piece of wood by sighting down the length, feeling the quality of finish of an object by sense of touch, etc.

2.3 Social Skills:
e.g. accepting and offering criticism in a constructive manner, taking care for the safety of others in the workshop, working as a team to unload lengths of timber, etc.

2.4 Analysis and Problem Solving Skills:
e.g. analysing the various functions of a table, designing a table, listing the advantages and disadvantages of a design, etc.

2.5 Memory Skills
e.g. remembering the correct sequence of operations in cutting a mortice joint, remembering the names of joints, remembering to point a chisel away from the body, etc.

3. CONTENT

3.1 Safety regulations and precautions in the workshop.

3.2 Graphic communication: use of simple sketches to communicate ideas. Freehand sketching in Isometric and Orthographic projections, with or without grid paper.

3.3 Introduction to design: fitness of purpose, the right use of materials and principles of sound construction.

3.4 Use and care of the following tools:

Measuring and Marking Tools	: Rule, pencil, trysquare, marking gauge, sliding bevel, templates, mortice gauge and squaring rods.
Saws	: Tenon saw, corsscut saw, panel saw, rip saw, coping saw, pad saw, compass saw, and bow saw.
Chisels	: Bevel edged chisel, firmer chisel, and mortice chisel.
Planes	: Jackplane, smoothing plane, plough plane, scraper and spokeshave.
Boring Tools	: Brace, twistbits, speed bore bits, countersink bit, hand drill and bradawl.
Miscellaneous	: Warrington pattern hammer, claw hammer, mallet, pincers, nail punch, screw driver, rasp, oilstone, bench grinder and files.
Holding Tools	: Woodworker's vice, bench hook, 'G' cramp, bench holdfast, sash cramp, tension ropes and wedge boards.

3.5 Preparation of sawn timber to size and use of face marks.

3.6 Construction and use of the following joints, incorporated as often as possible into useful articles.

Nailed butt joint, Tee and cross half lap joints; dovetail half lap joint, through and stopped mortice and tenon joints, haunched and wedged mortice and tenon joints, housing and through dovetail joints.

3.7 Simple jigs and fixtures.

3.8 Edge joints; loose tongue and grooved joint, rubbed and glued joint.

3.9 Shooting and working of end grain.

3.10 Table and stool construction.

3.11 Flat frame construction.

3.12 Carcase construction.

3.13 Fixing tops: button method and screw plate method.

3.14 Timber: conversion by the through and through method and the quartering method, advantages and disadvantages of both methods.

3.15 Seasoning of timber: the kiln method and the air drying method.

3.16 Timber recognition: hardwoods and softwoods, characteristics and uses of four commercial timbers used in this country (e.g. Pine, Saligna, Mukwa, Mahogany.) and an imported timber (e.g. Meranti).

3.17 Manufactured boards: structure and use of local boards, i.e. blockboard, chipboard and plywood.

3.18 Abrasives: use of the various grades of abrasive papers.

3.19 Adhesives: use and application of P.V.A. and waterproof glues.

3.20 Fastenings: the use and sizes of locally obtained wire nails, oval nails, panel pins and woodscrews.

3.21 Fittings: sizes and uses of common fittings obtained locally. Butt hinges, cupboard locks, drawer locks, catches and barrel bolts.

3.22 Finishes: use of paint, sanding sealer, polyurethane lacquers and wax polish.

4. EVALUATION

The evaluation of the Woodwork course will be based on three components.

a)	Course work assessed by the teacher.	(30 marks)
b)	A practical test piece set by the Chief Examiner	(40 marks)
c)	A theory and drawing paper.	(30 marks)

4.1 Course work:

The course work mark will be averaged from at least five practical projects undertaken by the pupil over the two year period of the course. The following marking scheme should be used as a guide when allocating marks;

Accuracy	8 marks
Fitting of joints	7 marks
Finish	7 marks
Attitude to work, teacher and other pupils	8 marks
TOTAL	30 marks

4.2 Practical Set Piece

The Chief Examiner will set a simple piece of practical work designed to test the pupils' skill in aspects of the syllabus. The time allowed will be 3 hours. Details of materials required will be sent to schools during the second term so that schools have plenty of time to obtain them. The test will be conducted early in the third term (of second year) and forwarded to regional centres for marking.

4.3 Theory and Drawing Paper:

This will be of 1½ hours duration. There will be two sections.

SECTION A	20 multiple choice questions	(10 marks)
SECTION B	Pupils will choose 5 questions from 7 which may require simple sketches.	(20 marks)

✓ WOODWORK
(6030)
G.C.E. ORDINARY LEVEL/SCHOOL CERTIFICATE

The examination is designed to test the candidates' skill in drawing and practical work, their knowledge of tools and materials and their understanding of methods and principles of construction. Importance will be attached to designing ability, the use of information and the solving of problems.

Candidates retaking this subject may not carry forward the marks of any paper from a previous examination.

Scheme of examination

Paper 1 (99 marks). A 2¼-hour paper on theory, drawing and design.

This paper will be divided into two sections.

Section I will be further divided into Parts A and B. Part A (25 marks) will consist of short-answer questions based on Workshop Practice and Technology as set out in the detailed syllabus given below. Part B (24 marks) will consist of four questions requiring longer answers, set on any part of the syllabus, from which candidates will be required to attempt any two.

Section II, based on Drawing and Design (50 marks), will contain a series of inter-related compulsory questions about a piece of furniture or other wooden construction within the experience of the candidates. **Candidates will be informed of the general nature of the furniture or construction about three weeks before the date of the examination.**

Paper 2 (100 marks). The 3 hour Practical Examination will consist of a simple construction usually found as part of a piece of furniture or fitting and may in addition include a setting-out problem.

The test may require the use of *(a)* common hand-tools, *(b)* one or more joints in a given construction, *(c)* nails and screws as means of fastening, *(d)* butt hinges. Candidates may be required to work from dimensioned sketches, from a written description or from scale drawings.

Candidates should be familiar with the following joints and their application to woodwork constructions; halvings—simple and dovetailed; housings—through, stopped and simple dovetail; tenons—through, stopped, haunched (with or without a groove); bridles—simple and dovetailed; dovetails—common and lapped, long and short shouldered mortise and tenon joints without mouldings.

SYLLABUS

Workshop Practice and Technology

An elementary knowledge of the following will be required.

(a) The common woodworking tools and their uses, construction, sharpening and maintenance.

(b) Timber: characteristics of soft and hard woods in common use and their suitability for particular purposes; growth, conversion and seasoning; simple moisture content testing; simple strength of materials testing; the behaviour of timber during the drying process; common defects and pests. Plywood, laminated boards, manufactured boards such as hardboard and plastic faced boards.

Simple moisture content testing by experimental and comparative methods (excluding chemical and electrical techniques). Simple strength of material testing; comparative mechanical strength of timber along and across the grain; bending in simply supported beams (e.g. a shelf); comparative density testing.

(c) The use of glue, modern adhesives for wet or dry conditions; glass and abrasive paper or cloth; screws, nails, furniture hardware and fittings including magnetic and nylon catches; stains and polishes including water repellent/heat resisting hard finishes, paints and preservatives.

(d) Construction and processes; common joints and their uses, particularly joints referred to in

the syllabus for the practical examination. Knowledge of the three main types of construction work: stool and table construction; flat frame construction, box and carcase construction including drawers; veneering.

Experience in fields other than cabinet-making, e.g. carpentry and joinery, sculpture and free form work in wood, rural crafts, turning, boat-building and laminated structures are considered to be valuable extensions of coursework.

(e) Designing in relation to woodworking constructions, e.g. fitness for purpose, general proportions, suitable construction, contour and surface decoration, appropriate finish.

(f) An understanding of the common safety precautions to be observed in school workshops.

The examination will include questions bearing on constructions in wood, or wood in combination with other suitable materials, likely to test the candidate's ability to solve problems and apply workshop knowledge creatively.

Drawing and Design

The nature of the questions will be made known not less than three weeks before the examination day, giving the candidates time and opportunity to consider the problems involved.

The examination may test the following.

(a) The ability to make and read properly dimensioned working drawings to scale in accordance with B.S.I. standards.* (Diagrams printed in the question papers may be in either First or Third Angle projection; the projection used will be stated. Solutions in either First or Third Angle projection will be accepted.) Normal drawing office practice using drawing board, tee-square or parallel motion straight-edge, scale rules and drawing instruments. The only sections required will be those parallel to the vertical or horizontal planes.

(b) Knowledge of construction in wood and methods of showing this by means of sketches, isometric or oblique projection or other methods of pictorial representation. Importance will be attached to the ability to communicate ideas by sketching.

(c) Layout of drawings, dimensioning and hand-lettering.

(d) Understanding of design in relation to woodwork, together with an ability to communicate design ideas in graphic form through the use of sketches suitably rendered in pencil and/or colour.

Marks will be awarded in the examination for the quality of ideas in design, technical knowledge and draughtsmanship.

* *Engineering Drawing Practice*. The British Standards Institution specifications. P.D. 7308.1980 and *Building Drawing Practice* B.S. 1192: 1969.

QUESTIONNAIRE

Appendix 3:1

My name is Charles Nherera. I am a student at Linköping University in Sweden. I am carrying out a research study concerning Woodwork in secondary schools. Please give accurate information in the spaces provided. If any part is not clear to you, please ask for clarification. All answers will be treated confidentially.

1. Your name.....

2. Gender:

Male	(____)1
Female	(____) 2

3. Class: Form.....

4. Your age: ..... years old

5. Indicate how long you have been at this school.

1 year	(___) 1
2 years	(___) 2
3 years	(___) 3
4 years	(___) 4
more than 4 years (indicate how long).....	

6. Indicate which subjects you are studying.

English Language	(___) 1
English Literature	(___) 2
Mathematics	(___) 3
Shona	(___) 4
General Science	(___) 5
Physics	(___) 6
Chemistry	(___) 7
Geography	(___) 8
Woodwork	(___) 9
Metalwork	(___)10
Fashion and Fabrics	(___)11
Food and Nutrition	(___)12
Religious Education	(___)13
Technical Drawing	(___)14
Others (state which).....	

7. Did you attend another secondary school before coming to this one?

Yes	(___) 1
No	(___) 2

8. If you did, indicate which technical subjects you studied, if any.

Agriculture	(___)1
Woodwork	(___) 2
Metalwork	(___) 3
Technical Drawing	(___) 4
Fashion and Fabrics	(___) 5

Others (state which).....

.....

9. Indicate how many teachers have taught you Woodwork since you came to the present school.

More than 4	(___) 1
3 teachers	(___) 2
2 teachers	(___) 3
1 teacher	(___) 4

10. How many articles have you made in Woodwork practicals this year?

Name them: 1.....

2.....

3.....

4.....

5.....

6.....

11. The teacher decides what articles are to be made.

(a) strongly agree	(___)
(b) agree	(___)
(c) not sure	(___)
(d) disagree	(___)
(e) strongly disagree	(___)

12. Individual pupils decide their own articles.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

13. Both the teacher and the pupils decide the articles to be made.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

14. Pupils are given timber already cut to size.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

15. The teacher demonstrates new skills and processes such as cutting of joints, use of tools, etc.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

16. The teacher tells pupils what to do at every stage during practical work.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

17. The teacher expects pupils to discuss problems in practical work and decide how to proceed.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

18. Do you keep a sketch-book, file or sheets of paper in which you make sketches and notes related to your practical work?

Yes (___)

No (___)

19. Do you make models or mock-ups of the articles to be made?

Yes (___)

No (___)

20. Do you sometimes discuss and make comments on individual articles as a class?

Yes (___)

No (___)

21. When you finish making an article, do you assess it and suggest how the article could be improved?

Yes (___)

No (___)

22. Woodwork practical work mostly involves copying the teacher's models or working drawings accurately.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

23. Pupils are encouraged to come up with their own ideas about the articles they make.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

24. A lot of thinking is required in Woodwork.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

25. Pupils are encouraged to think independently without relying on the teacher all the time.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

26. Woodwork is only suitable for the less able pupils.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

27. Woodwork is suitable for both the able and less able pupils.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly (___)

28. Groupwork is encouraged in Woodwork.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

29. The time set aside for Woodwork on the timetable is enough.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly (___)

30. Do you like Woodwork?

Yes (___)

No (___)

Not sure (___)

Thank you

Interview With Teachers / Questionnaire

1.Name of teacher.....

2. Gender:

Male (___)1

Female (___)2

3. Professional qualifications.....

4. Where trained.....

5. Teaching experience.....

6. Other working experience.....

7. For how long have you been at this school?.....

8. Any other schools taught before coming to this school

School	Subject taught	Period
.....	.....	19 ... to 19.....
.....	.....	.....
.....	.....	.....
.....	.....	

9. Subjects currently taught:

Subject	Class	Periods/week
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

10. Time allocation for Woodwork lessons per week:

Practical:.....periods/week

Theory:..... - -

Drawing:..... - -

11.Do you share the workshop with other teachers?

Yes (___)1

No (___)2

12. Do you use more than one workshop?

Yes	(___)1
No	(___)2

13. Do you prepare your own schemes of work?

Yes	(___)1
No	(___)2

14. You adhere strictly to the official syllabus from the Ministry?

(a) strongly agree	(___)
(b) agree	(___)
(c) not sure	(___)
(d) disagree	(___)
(e) strongly disagree	(___)

15. The syllabus specifies all topics to be dealt with by the teacher.

(a) strongly agree	(___)
(b) agree	(___)
(c) not sure	(___)
(d) disagree	(___)
(e) strongly disagree	(___)

16. The syllabus specifies how the topics should be dealt with.

(a) strongly agree	(___)
(b) agree	(___)
(c) not sure	(___)
(d) disagree	(___)
(e) strongly disagree	(___)

17. The teacher is free to deal with topics in the manner he sees fit.

(a) strongly agree	(___)
(b) agree	(___)
(c) not sure	(___)
(d) disagree	(___)
(e) strongly disagree	(___)

18. The teacher decides the articles to be made for practical work.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

19. Individual pupils decide their own articles.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

20. Both the teacher and pupils decide the articles to be made.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

21. Do pupils maintain sketch-books, files or sheets of paper in which they make sketches and notes related to their practical work?

Yes (___)1

No (___)2

22. Do pupils make models or mock-ups of the articles to be made?

Yes (___)1

No (___)2

23. Do pupils discuss as a class and make comments on individual articles suggesting improvements?

Yes (___)1

No (___)2

24. Pupils are not allowed to make any changes to their articles as they make them.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

25. The teacher demonstrates and shows how pupils should proceed at different stages.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

26. Pupils cannot proceed to a new stage in their practical work without consulting the teacher.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

27. The training of mannual skills is the most important aspect in Woodwork.

(a) strongly agree (___)
(b) agree (___)
(c) not sure (___)
(d) disagree (___)
(e) strongly disagree (___)

28. Practical exercises are mainly concerned with how well a pupil can follow instructions, working drawings and models accurately.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

29. Pupils evaluate their articles and suggest how they could be improved.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

30. Pupils are encouraged to think independently without relying on the teacher all the time.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

31. Pupils are not experienced enough to come up with their own ideas in practical work.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

32. Woodwork is mainly suitable for the less able pupils.

(a) strong agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

33. Groupwork is encouraged in Woodwork.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

34. The time set aside on the timetable for the subject is sufficient.

(a) strongly agree (___)

(b) agree (___)

(c) not sure (___)

(d) disagree (___)

(e) strongly disagree (___)

THANK YOU

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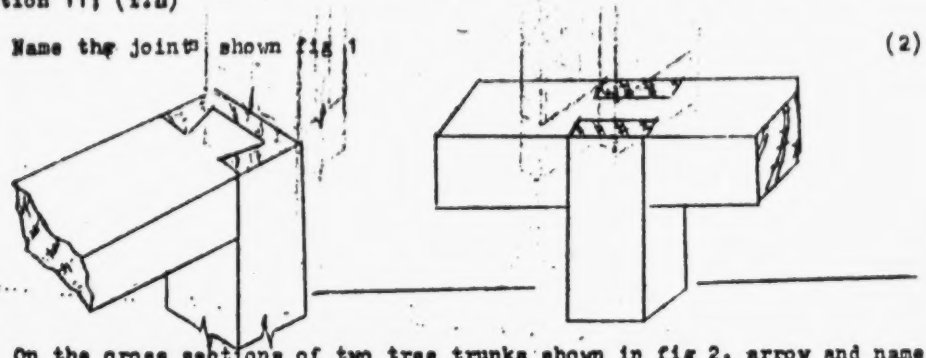
END OF YEAR EXAMINATION 1988

WOODWORK FORM III — Theory Design and Drawing

TIME: 2 hrs 30 mins — Marks 100

Answer all questions from section 1A, two from section 1B and all from section 11; (T.D)

1. Name the joints shown fig 1 (2)



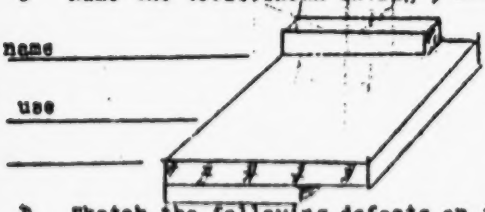
B On the cross sections of two tree trunks shown in fig 2, arrow and name
(i) The layer where main growth takes places.
(ii) The rings which are formed each year.
(iii) The matured wood mostly liked by wood worker.
(iv) The rays which produce figure in some timbers (A) (5)

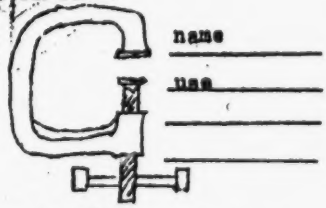
A

B

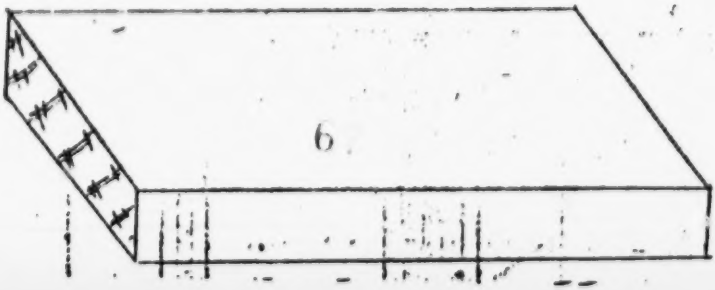
(v) On B show how the tree would be cut for slab/through and through conversion.

C Name the tools shown in fig 3 and give one use of each.

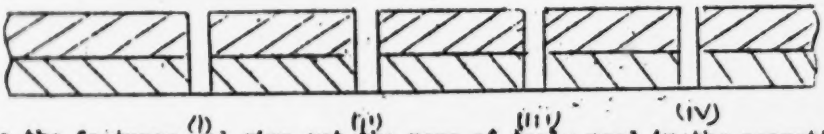




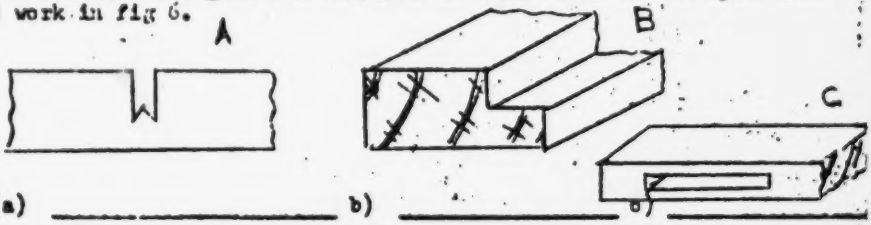
D Sketch the following defects on the board shown in fig 4.
(i) A check or end split (ii) Knot (2



E. On the cross section of two pieces of wood in fig 5, show the following fittings in place.
(i) A 25 mm countersunk head screw
(ii) A 25 mm round head screw
(iii) A 15 mm panel pin
(iv) A 25 mm french wire nail. (4



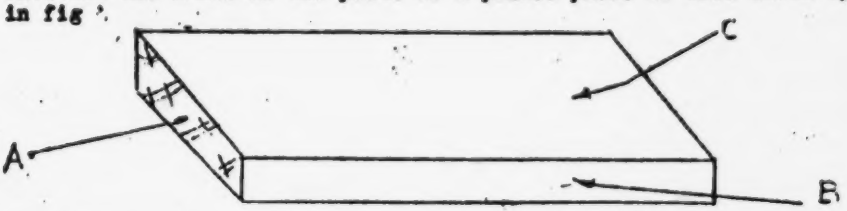
F. Name the features and give out the name of tools used in the operation of the work in fig 6.



Name (a) _____ b) _____ c) _____

Tool used (i) _____ (ii) _____ (iii) _____

G. Give out the names of the parts of a planed piece of wood shown by arrows in fig 7. (3



A _____ B _____ C _____

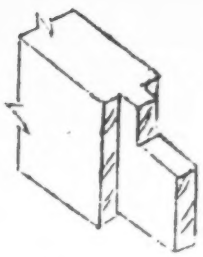
SECTION B

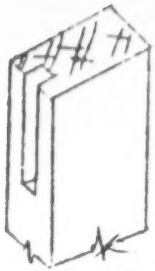
Answer only two questions from part B on the answer paper provided. Each question in this part carries 12 marks.

2. (i) Make well proportioned sketches of two types of chisels naming the chisels and the main parts of each.
(ii) Using notes and sketches explain a correct use for each tool. (12

3. With a sketch and notes, briefly describe how you would prepare the scotch glue ready for use. (12

4. The diagram below shows a joint used in woodwork.
(i) Name the joint and say where it is used.
(ii) Explain how you would mark out the joint in preparation for cutting assuming the wood has been prepared to size.





5. Manufactured boards are used increasingly in the production of furniture
   (i) Sketch section through each of these different boards, show construction of the core and name the boards.
   (ii) Name a use for each board. (12
   (iii) Sketch the corner of a small table top made from manufactured board showing a method of concealing the edges. Name the board you have used.

b. For what purpose would you employ the following joints.
   (i) Common mortice and tenon joint.
   (ii) Through housing joint
   (iii) Corner dovetail joint
   (iv) Cross halving joint
   Illustrate answers by sketch drawings (12)

SECTION II DESIGN AND DRAWING

(i) On the space to the right of the vertical line, make a free hand sketch of a handle to your own design to be fixed on the ends of Tea Tray.

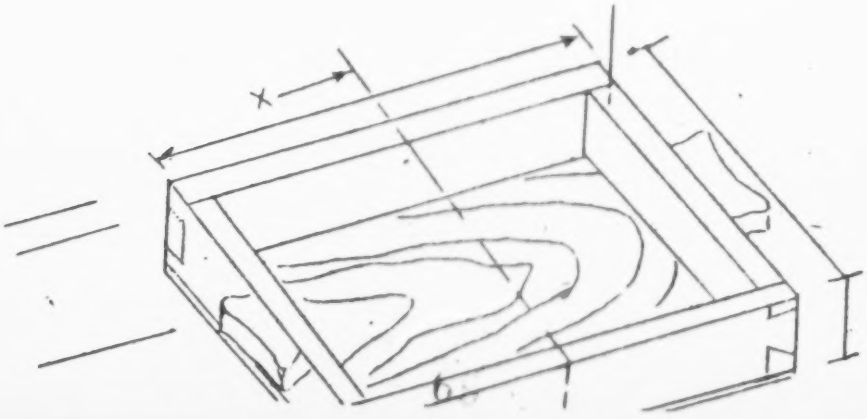
(ii) Draw the joint in explored view used in the making of the model.

(iii) Using the dimensions given drew front elevation looking in direction of arrow A.

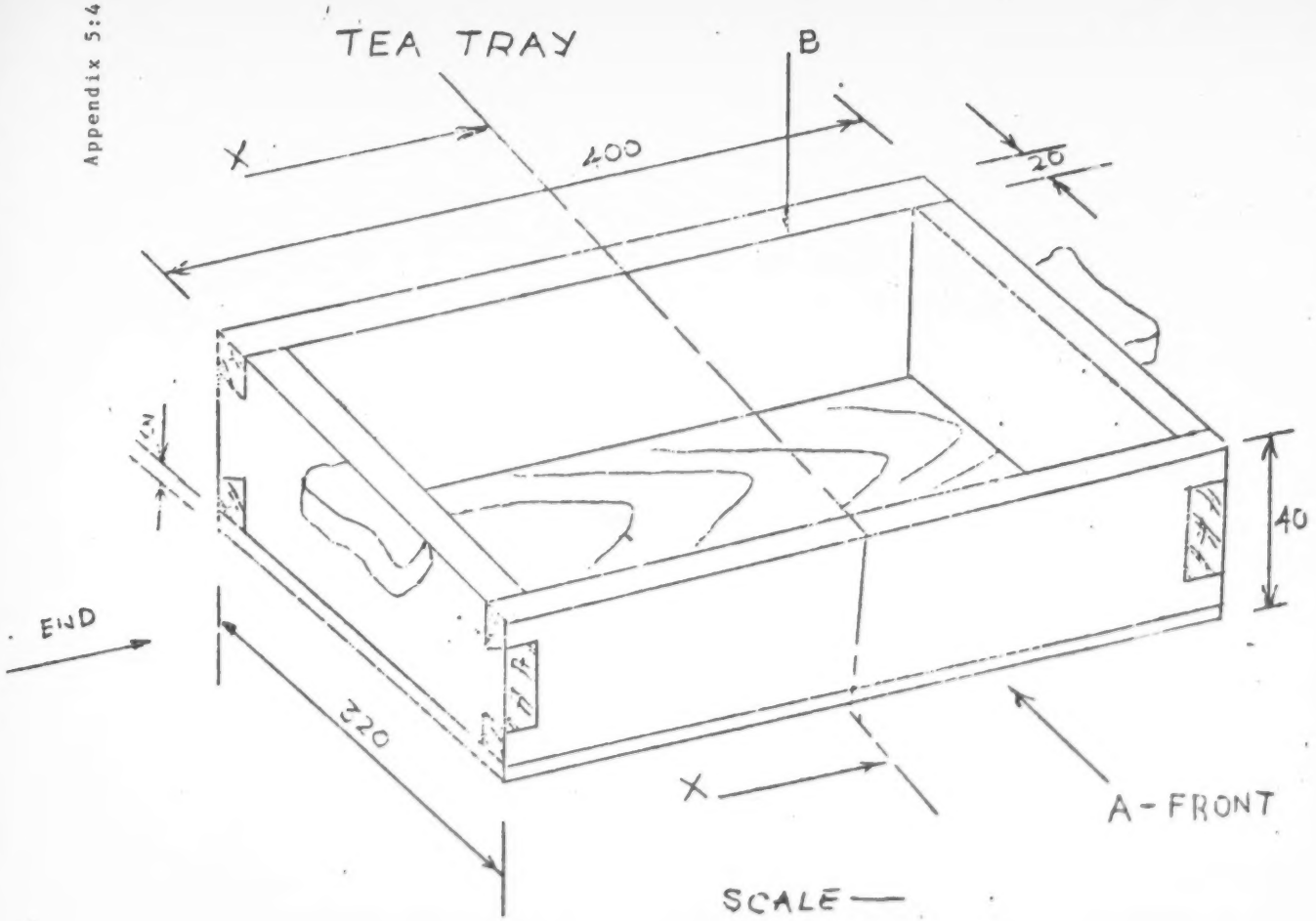
(iv) A sectional end view of the part to the right of the section line xx

(v) A plan view looking in the direction of arrow B.

(vi) In the title box include (A) The projection you are using. (B) Name of the cabinet (C) Scale to be used.
(D) Date you are writing (E) Name and class (7)



Appendix 5:4



Examples of Marking Schemes used in the department, copied by the researcher from one of the teachers.

Practical Work Marking Scheme:
Form 2 (Picture Stand)

1. Planing and Accuracy	10 marks
2. Crossing-Halving	10 "
3. Stopped, Square Haunched M &T Joint	15 "
4. Square, Haunched Mortice & Tenon Joint	15 "
5. Grooving	5 "
6. Shaping	5 "
7. Finish	5 "
TOTAL	70 marks

Note: *This marking scheme is based on the marking guide provided in the official syllabus (see item 4 in Appendix 1).*

Design and Drawing Marking Scheme

Form 3 (Tea Tray)

1. Front Elevation	8 marks
2. Sectional Elevation	7 "
3. Plan	5 "
4. Layout	9 "
5. Title Box	6 "
6. Handle	5 "
7. Joint	10 "
TOTAL	50 marks

Statistical summaries of responses from pupils.

Note: The tables are numbered in relation to the items in Appendix 3.

3. Class

Bar:	Element:	Count:	Percent:	
1	F. 1 A1	17	8.416	
2	F. 1 A2	20	9.901	
3	F. 1 A3	19	9.406	
4	F. 1 A4	14	6.931	
5	F. 1 A5	24	11.881	-Mode
6	F. 1 A6	19	9.406	
7	F. 1 A7	13	6.436	
8	F. 3 A3	18	8.911	
9	F. 3 A4	16	7.921	
10	F. 3 B1	15	7.426	
11	F. 3 B2	16	7.921	
12	F. 3 B5	11	5.446	

4. Your age

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
15.411	1.321	.093	1.746	8.574	202
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
13	20	7	3113	48325	0

5. Indicate how long you have been at this school

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
1.719	.949	.067	.9	55.228	202
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
1	3	2	347	777	0

7. Did you attend another secondary school before coming to this one?

Bar:	Element:	Count:	Percent:	
1	Yes	9	4.455	
2	No	193	95.545	-Mode

8. If you did, indicate which technical subjects you studied, if any

Bar:	Element:	Count:	Percent:	
1	Agriculture	0	0	
2	Woodwork	7	77.778	-Mode
3	Metalwork	0	0	
4	Tech. Drawing	2	22.222	
5	Fashion & Fabrics	0	0	
6	Others	0	0	

9. Indicate how many teachers have taught you Woodwork since you came to the present school

Bar:	Element:	Count:	Percent:	
1	More than 3	29	14.356	
2	Three 3	42	20.792	
3	Two 2	9	4.455	
4	One 1	122	60.396	-Mode

11. The teacher decides what articles are to be made

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
1.733	.929	.065	.864	53.631	202
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
1	5	4	350	780	0
Mode:					
1					

12. Individual articles decide their own articles

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
3.421	1.303	.092	1.698	38.089	202
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
1	5	4	691	2705	0

13. Both the teacher and pupils decide the articles to be made

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.564	1.36	.096	1.849	53.027	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	518	1700	0

14. Pupils are given timber already cut to size

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
3.505	1.19	.084	1.415	33.944	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	708	2766	0

15. The teacher demonstrates new skills and processes such as cutting of joints, use of tools, etc.

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
1.748	.887	.062	.787	50.755	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	353	775	0

16. The teacher tells pupils what to do at every stage during practical work

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
1.579	.73	.051	.533	46.252	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	319	611	0

17. The teacher expects pupils to discuss problems in practical work and decide how to proceed

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.485	1.294	.091	1.674	52.061	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	502	1584	0

22. Woodwork practical work mostly involves copying the teacher's models or working drawings accurately

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.193	1.192	.084	1.42	54.341	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	443	1257	0

23. Pupils are encouraged to come up with their own ideas about the articles they make

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
3.208	1.363	.096	1.857	42.48	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	648	2452	0

24. A lot of thinking is required in Woodwork

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
1.891	1.021	.072	1.043	53.999	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	382	932	0

25. Pupils are encouraged to think independently without relying on the teacher all the time

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.658	1.245	.088	1.549	46.823	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	537	1739	0

26. Woodwork is only suitable for the less able pupils

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
3.634	1.161	.082	1.348	31.949	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	734	2938	0

27. Woodwork is suitable for both the able and less able pupils

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.139	1.013	.071	1.025	47.351	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	432	1130	0

29. Groupwork is encouraged in Woodwork

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.847	1.198	.084	1.434	42.069	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	575	1925	0

29. The time set aside for Woodwork on the timetable is enough

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.347	1.097	.077	1.203	46.736	202
Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	5	4	474	1354	0